GARDNER MINE

There was no work done at the Gardner Mine during the month of December 1914.

WORK FOR YEAR

The work of installing brackets and steel sets in the concrete shaft was started in January and completed early in March.

Grouting the weep holes near the bottom of the shaft was then started. These holes having been left open at the time the New York Foundation Company finished their work, as the concrete was green. The first hole grouted was near the bottom of the shaft, very little water was being made in this hole and after a few minutes grouting the flow was entirely stopped. When attempting to grout the second hole, located on the North wall and below the original seal, it was found that the water and grout came out along the North wall at the contact of the top of the steel shoe and concrete. The second hole was then plugged and a water tight form constructed along the North wall at the contact of top of steel shoe and concrete this form was braced by stulls from the South wall. Grouting was then forced back of this form under pressure. After the pressure had been on a short time a fresh crack was discovered in the concrete a few feet below the form. The pressure was then removed and holes drilled in the concrete at different elevations to ascertain at what depth the water was circulating in the concrete wall. From these holes it was demonstrated that the source of the water was near the original seal and that the water was flowing between the original concrete wall and the 6" wall that was constructed after the original seal was made. showing that there was an open seam between the two walls. The concrete along the North wall was then removed, forms built and fresh concrete poured. A 2" pipe was then placed in the weep hole that was drilled just below the cutting edge and practically all the water that was being made in the shaft came through this hole.

The work of cleaning up the shaft was then started and completed on

April 20th.

The work of sinking the shaft was started on April 21st and continued throughout the year on two eight hour shifts up to September 30th, at which time the work was stopped for an indefinite period.

The elevation of the bottom of the shaft September 30th was 776.83 feet or 334.64 feet below the collar of the shaft.

Total depth sunk below concrete 220.05 feet.

UNDERGROUND IN GENERAL

The work of cutting out 1st Level plat was started on the North and West sides of the shaft at an elevation 300 feet below the surface of the ground. Rock was also excavated for pocket on West side of the shaft. It was planned to utilize this pocket for a temporary sump for electric sinking pump.

Practically no water was encountered after sinking was started. The greater part of the water was made through the weep hole on the North wall of the concrete just below the cutting edge.

GARDNER SURFACE

The following work was done during the year 1914:

Land was cleared on East and West sides of the shaft on site for stockpile grounds, and then seeded down for fire protection.

Electric hoist, built by Lake Shore Engine Works for Francis Mine, was installed in Gardner engine house and iron railing constructed for safety device.

Sheaves were placed on pulley stands and ladders and railings placed on stands for safety device.

Plank laid on landing floor of head frame and railing constructed for safety device.

A powder house was erected at a point 360 feet Southwest of Mackinaw Shaft and 875 feet Northwest of Gardner Shaft. This house was used to store powder for both the Gardner and Mackinaw Mines.

A 4" plank floor was laid on bottom of pockets in head frame.

A temporary landing floor for bucket, chute and two sets of doors for safety device were installed at shaft.

The 6" discharge pipe from Gardner Shaft was extended 230 feet West thence Northeast 95 feet. From this point a ditch was dug for 650 feet to the West and connected with main ditch from Mackinaw Mine.

Three car loads of Fir timber were shipped from the Francis Mine and unloaded at the Gardner Mine.

GENERAL SURFACE

SECTION 2 - 44 - 25

Repairs were made on old Diamond Drill camp buildings. The buildings were used for boarding house and bunk house previous to the closing down of the Mackinaw and Gardner Mines.

SECTION 35 - 45 - 25

The barn that was under construction for the Mackinaw and Gardner Mines was completed early in the year.

GARDNER MACKINAW LOCATION

Five more double houses were erected in the Gardner Mackinaw Location.

A 6" sewer line was laid to accommodate these houses and connected with man-hole that was constructed last year.

A lighting line was erected from the Sub. Station at the Mackinaw. Mine to the location to furnish electric lights for the company houses.

Boundary fences were erected in the Location and fences stained.

A school building was erected by Forsyth Township in East end of the location and a school yard enclosed by boundary fence.

GWINN TOWNSITE

The gravel on West Roadway of Pine Street from Mineral to Jasper was removed and replaced with crushed rock, the above work being done by Forsyth Township.

A catch basin was also constructed on West side of the roadway between lots 4 and 5. Block 13.

BUILDINGS

A building was erected for Catholic Parsonage on Lot No. 4 of Block No. 33 - North of Iron Street.

A private residence was erected on Lot No. 3 of Block No. 16.

A brick building for Town Hall is being erected by Forsyth Township on Lot No. 1 of Block No. 4, on West side of Pine Street. This building is a

fine looking structure and is a great improvement to this part of the town.

The depression in the iron market had its effect on the building in Gwinn. Only three buildings were erected in the Townsite, while if conditions were better others would probably have been built.

PLANTING

Shrubs were planted in the beds along the streets in Cemetery, this planting being done by Forsyth Township.

Engleman's Ivy was planted along West wall of Hotel building and East wall of bank building.

Maple trees were gathered in the woods and planted to replace those that died last year.

The planting that was done at the grounds of the Gwinn Station by the Railroad Department last fall made a good growth this past season and has greatly improved the appearance of the grounds.

GWINN ASSOCIATION

The Association campmon Bass Lake was completed early in July and camp opened with a picnic for the association members.

Moving Picture machine was installed at the Club House early in May and three shows a week have been given since this time. These entertainments have been for club members only, a nominal charge of 10 cents being made for adults and five cents for children. This has proved to be a very popular, their attendance having been good at these entertainments the greater part of the time. The moving pictures have brought people to the Club House that otherwise would have remained away. Many of these are now enjoying the priviledges the Association offers and are much more interested in their membership than they were a year ago.

CENTRAL POWER PLANT

Repairs were made on Central Power Plant Coal Dock where legs, braces and sides were injured by fire. Quite a number of new caps and corbels were also put in to replace old ones that were decayed.

An explosion occured in transformer building on night of April 28th

and wrecked the South wall of the building. The cause of the explosion is unknown but it is likely that gas was generated in some way and ignited by a flash from the lightning arresters. The damaged wall was taken down and a new one erected.

FIRES

Due to the extreme dry weather during the months of May and June a good many forest fires occured during these months. They were as follows:

May 8th. A fire started on Southeast $\frac{1}{4}$ of S. E. $\frac{1}{4}$ Section 22 - 45 25 and burned over about 1 acre, consisting of grass and small Jack Pine.

May 9th. A fire started on S.W. $\frac{1}{4}$ of N.W. $\frac{1}{4}$ Section 26 - 45 - 25 and burned over about four acres, consisting of grass and brush.

May 12th. A small fire occurred in the Town of New Swanzy in S.W. $\frac{1}{4}$ of S.W. $\frac{1}{4}$ Section 22 - 45 - 25. This fire spread from a fire that was started to burn rubbish. It was soon got under control and no damage done.

May 14th. A fire started on Southwest $\frac{1}{4}$ of S.W. $\frac{1}{4}$ Section 2 - 45 - 25 and spread to N.W. $\frac{1}{4}$ of N.W. $\frac{1}{4}$ Section 11 - 45 - 26, burning over about 80 acres consisting mostly of grass and brush.

May 16th. A small fire occured along the M. M. & S. E. Ry. on S.E. $\frac{1}{4}$ of S.E. $\frac{1}{4}$ Section 22 - 45 - 25. No damage done.

May 18th. A small fire occured on S.E. $\frac{1}{4}$ of S.E. $\frac{1}{4}$ Section 22 - 45 - 25, burning over about one half acre.

May 18th. A fire started in S.W.Corner of T 44 N, R 25 W, and spread North and West to Section 17, T 44 N, R 25 W, and North along the West side of T 44 N, R 25 W, to Sections 5 and 6. This fire covered a large area and burned on the Northern limit of the fire up to May 25th. The damage done was not very great as land burned over consisted mostly of old slashings, Jack Pine, Poplar, and a few scattering White Pine and Hemlocks.

May 18th. A fire also occured on N.W. $\frac{1}{4}$ of N.W. $\frac{1}{4}$ Section 26 - 45 - 25 burning over about 4 acres.

May 12th. A small fire occured on S.E. $\frac{1}{4}$ of S.E. $\frac{1}{4}$ Section 19, T 45 N, R 25 W. No damage done.

June 9th. A fire started in the N.E. 4 of N. E. 2 Section 29, T 45 N,

R 25 W., and spread on to Section 28 and 21 covering an area of about 15 acres. This fire was started by sparks from M. M. & S. E. Ry. engine. There was a very high wind blowing at the time the fire occured and it took a large force of men to get it under control. This fire was especially dangerous as the wind was blowing towards the Gwinn Townsite.

June 16th. A fire occured in S.E. $\frac{1}{4}$ of S.E. $\frac{1}{4}$ Section 19, T 45 N, R 25 W., and burned over about one acre.

June 16th. There was also a fire on S.W. $\frac{1}{4}$ of S.W. $\frac{1}{4}$ Section 20, T 45 N, R 25 W, burning over about one acre. No damage done.

May 30th. A fire started on N.E. $\frac{1}{4}$ of S.E. $\frac{1}{4}$ Section 17 - 45 - 25 and continued to burn up to June 2nd. This fire spread on to Sections 8 and 9 and burned over about 480 acres.

June 1st. A fire occured on N.W. $\frac{1}{4}$ of Section 18, T 45 N, R 25 W and covered an area of about three acres consisting of grass and brush.

June 5th. A fire occured on Section 17, T 45 N, R 25 W. This fire started from smouldering logs from the fire of June 2nd and burned over an area of about 50 acres consisting mostly of old slashings and brush.

June 9th. A fire started on N.E. 1 of N.E. 1 Section 18, T 45 N, R 25 W., just across the river from the Pump Station. This fire covered about 20 acres but was soon got under control.

ACCIDENTS

There were no fatal accidents in the Gwinn District furing the year 1914.

Safety devices and appliances were provided where ever possible and these doubtless have had the effect of reducing the number of accidents.

ANALYSIS OF COST SHEETS

Below is a comparison of the Cost Sheets for the years 1913 and 1914 for the operating mines in the Gwinn District:

STEPHENSON MINE	1913	1914	INCREASE	DECREASE
Average Product for Month,	21,331	17,884		
General Expense, Maintenance,	.144	.158	.014	
Mining Expense,	1.078	1.120	.042	
TOTAL	1.387	1.445	.058	

The Details making up these differences follow:

STEPHENSON MINE.

COMPARATIVE MINING COST FOR YEAR.

	1914	1913	INCREASE	DECREASE
PRODUCT	214,608	255,979		41,371
General Expense	•158	•144	.014	
Maintenance	.167	.165	.002	
Mining Expense	1.120	1.078	.042	
Cost of Production	1.445	1.387	•058	
DEPRECIATION				
Plant	.103	•289		•186
Equi pment	•002		•002	
New Construction		•005		•005
Total Depreciation	.105	.294		.189
Taxes	•031	•043		.012
Central Office	.079	•069	.010	
Sundry Expense	•032	•084		.052
Miscellaneous	•013	•005	•008	
Supply Inventory	•002		.002	
COST ON STOCKPILE	1.707	1.882		.175
Loading & Shipping	.012	•009	.003	
Total Cost on Cars	1.719	1.891		.172
Number days operating	279	302	7-167	.023
Number shifts and hours	2-8hr (125) 1-8hr (154)	2-8hr	43.17.	
Avg.daily product	769	848		
COST OF PRODUCTION				
Labor	.943	.972		
Supplies	•502	.415		
Total	1.445	1.387		

ANALYSIS OF COST SHEETS - For Years 1913 and 1914.

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	1913	1914	INC.	DEC.	REMARKS
COST OF PRODUCTION	1.387	1.445	.058		Detail of Increase Below:
GENERAL EXPENSE					
Engineering,	.015	.013		.002	More Engineering required in 1913.
Analysis,	.049	.043		.006	In 1913 there were 38,629 Determinations. In 1914 there were 32,998 Determina- tions and the cost per deter- mination in 1914 was less.
Personal Injury,		.009	.009		In Sept. 1914 the sum of \$1500.00 was paid to John Ruotsala in respect of accident Report No. 108 November 1st, 1911.
Mine Office,	.016	.021	.005		Increase due to the feed for Captain's Horse. Transfer of Princeton and Gardner Mack- inaw Clerks at higher rate than men laid off and in- creased telephone charge.
District Office,	•064	.071	.007		Princeton and Austin Mines not operated during 1914, in consequence of which a lar- ger proportion of District Office Expense was borne by Stephenson
MAINTENANCE					
Tracks and Yards,	.005	.007	.002		Building new road on Sur- face and laying out Dry House grounds.
Buildings,	•006	.007	.001		New roofing for office and warehouse and wiring shaft house. New roofing for boiler house and repairs to dry house heater. Repairs to coal dock trestle and extension of timber tunnel.
Shop Machinery,	.003		•003		Depreciation of drill sharp- ener at Central Shops charged Stephenson in 1914.
Hoisting Machinery,	.004	.003		.001	Less repairs to Hoisting Machinery.
Comp. & Power Drill	s,.008	.007		.001	In 1913 16 power drills were charged out whilst in 1914 only 12 were charged.

MAINTENACE (CONT D)					
Pumping Machinery,	.023	.012		.011	Decrease due to fact that in 1913\$1871.96 expended on water launder on surface, \$551.16 stand piping to test water and less expense for ditches and launders underground.
Top Tram Eng & Cars	,.014	.016	.002		Increase due to more repairs required to top tram system and building two new cars.
Skips & Skip Roads,	.007	.004		.003	Less repairs to skips and skip roads.
U. G. Tracks &Cars,	.008	.007		.001	Less repairs to Cars and Tracks on sub. levels.
Electric Tram Plant	.047	.055	.008		Increase due to purchase of 12 new main level cars in 1914 at a cost of \$2800.00.
Telephones and Safety Devices,	.003	•006	.003		Increase due to \$276.96 ex- pended for appliances for care of injured persons, safety de- vices for shaft house and pulley stands and trestles.
MINING EXPENSE					
Air Pipes,	.008	.009	.001		Increase due to more air pip- ing in mine on account exten- sion 5th Level cross-cuts and opening 6th Level.
Compressors,	.042	.073	.031		Princeton and Austin Mines did not operate in 1914, conse- quently Stephenson Mine bore a larger proportion of cost of Compressor Room charge.
Hoisting,	.039	.043	.004		Decreased tonnage but an engineer is retained on each shift when the mine is not operating.
Pumping,	.082	.093	.011		See note as to mine operations at foot.
Sinking and Shaft Repairs,	.002	.006	.004		Cutting 6th Level Plat in 1914.
Rock Drifting,	.085	.088	.003		2964 feet of Rock Drifting and Rock Raising in 1914, whilst in 1913 there was 3178 feet with a larger production.

	1913	1914	INC.	DEC.	REMARKS
MINING EXP. (CONT	(מי				
Breaking Ore,	.389	,381		.007	Decrease due to the produc- tion per man stoping having increased and also to decrease in wages paid miners.
Timbering,	.213	.20		.013	Less timber required in mine in 1914.
Captain and Bosses,	.045	.039		.006	Reduction of Bosses and de- crease of wages paid.
Stocking Ore,	.025	.037	.012		Increase due to erection of portable trestles for No. 2 ore and taking down and putting up Bessemer Trestle.

NOTE:

Mine operated 2 - 8 hour shifts from January 1st to June 1st, 6 days a week.

Mine operated 1 - 8 hour shift from June 1st to October 1st, 6 days a week.

Mine operated 1 - 8 hour shift from October 1st to Dec. 31st, 4 days a week.

about 36% REPUBLIC MINE. the fact that all new work on

GENERAL.

11. We have expended \$2,363.84 in safety work, which includes

The Republic Mine was purchased as of May 1st, 1914, and the expenditures for May month were cared for by our Company. We did not, however, take the management of the property until June 1st, and this report, therefore, covers the operations as carried on from that date, giving the results, only, for May month.

Following is a list of some of the changes in methods, new work undertaken, results secured, etc., during the seven months, June to December, 1914, both inclusive, viz:-

- Mine placed on one eight hour shift in place of two ten hour shifts.
- Surface and underground forces re-arranged and surface men reduced from a total of 92 to 54.
- 3. Working shafts reduced from five to two, thereby concentrating our operations and relieving us of the expense of maintaining three openings with their necessary hoisting machinery and equipment.
- 4. Forced up our production from 7,160 tons in May to 11,345 tons in December month, a gain of over 58%.
- 5. Our "tons per man per day" have been brought up from 1.25 in May to 1.83 in December, a gain of over 46%.
 - 6. The Guard Lock at Water Power Plant was entirely rebuilt at a cost of \$2,089.64.

The Dam at Michigamne Lake was repaired and raised at a cost of \$2,504.69.

The water end of the Water Power P lant was entirely rebuilt at a cost of \$4,626.06, which does not include a new water wheel which has yet to be installed.

- 7. Hoisting in No. 9 Shaft was changed from four ton to six ton skips, and two new skips of the larger size built.
- 8. Fifteen new two ton tram cars were built and placed in work underground.
- 9. The mining methods underground have been changed and the results are shown in our reduced labor costs per ton.

- 10. Our labor costs have been reduced from \$2.13 per ton in May month to \$1.37 per ton in December, a saving of about 36%, notwithstanding the fact that all new work on Water Power Plant, etc., has been charged to production in Monthly Cost Sheet.
- 11. We have expended \$2,363.84 in safety work, which includes an equipment of five two hour Rescue Helmets and a Pulmotor.
- 12. We have completed the remodeling of four dwelling houses, and they are now occupied by employees of the Company.
- 13. No. 9 Shaft was sunk a total of 128.5 feet, and the cutting of the new level plat commenced on December 1st.
- 14. Our production for the eight months has been 77,174 tons. An average of 400 tons per day.

SURFACE.

BUILDINGS.

All of our main buildings are in good repair and their cost of mainte-

Our two boiler and engine houses are of brick and stone construction and the balance are frame buildings.

The mine owns 51 dwellings, most of which have lately been repaired.

A few are in poor repair and will soon demand attention. During the summer houses Nos. 20 - 47 and 49 were remodeled and are now in first class condition. The exterior of house No. 31 (Superintendent's) was painted and several rooms papered. Rentals received from dwellings, lots, and pasture during the eight months total \$3,334.75.

DOCKS, TRESTLES, AND POCKETS.

At the time the property was taken over, the mine had more than its share of Trestles. This was on account of hoisting being carried on from so many openings. Since confining our hoisting to but two shafts, Nos. 9 and Pascoe, we have re-arranged and dispensed with a number of these long wooden structures.

During October month, we moved over 4,000 cubis yards of material to make stocking room at No. 9 Shaft, to care for the ore of Basic grade, which was formerly hoisted through No. 8 Shaft.

We have also added to our regular stocking area at No. 9 Shaft by filling in a large space with rock. This has been necessary in order to provide room for the winter's production, as very little ore was moved from stock during the past season.

We are well provided with stocking room except at Pascoe Shaft, where we will be cramped unless shipments are started reasonably early next season.

Our Coal Dock we found to be in need of repairs and this was given attention in June month. This dock is built entirely of wood, is old and will demand constant care.

Our Rock Trestle, which runs out into the bay from No. 9 Shaft, was added to during the summer and will need attention again very shortly.

Our Ore Pockets at tracks are old and in a bad state of preservation.

SHAFT HOUSES.

The Shaft Houses at both No. 9 and Pascoe Shafts are of steel construction and are in first class condition.

No. 9 Shaft House was built in July, 1913, at a cost of \$12,338.80, and is, therefore, new.

TRACKS AND YARDS.

Our Mine tracks are maintained by the railway companies and are of no expense to the mine.

Our Mine Yards, being located on the Mountain side, demand constant attention.

No railway tracks reach either of our shafts and all ore must be trammed to pockets as well as to stockpiles during stocking season, which means that top tram plants are operated the year around.

Maintenance costs are high for trestles, etc.

During the summer we ran a ditch around the south and east end of the property, to care for the surface water and keep it out of the mine.

CRUSHING AND SCREENING PLANT.

This plant was operated but a little during the past season and is in good state of repair and adequate for our present production.

During the past season, we have made some experiments with different size screens with good results on ore handled direct from mine, but some complaint was received on ore taken from stockpile, as having a large percentage of "Fines." We assume this was due to the friableness of this ore which resulted in a large breakage in transportation.

TOP TRAMS.

Our Top Tram plants have been reduced to two. Pascoe Shaft is served by an endless rope plant operated by electric power, and No. 9 Shaft has a gravity tram plant and car is pulled back by equipment attached to the hoisting sheave. This latter plant is not elastic and is not entirely satisfactory, and we plan on installing a positive electric plant, when changes are made in Shaft House for our proposed picking belt.

CARS, SKIPS, AND CAGES.

We have enlarged the skip at No. 9 Shaft so as to carry six tons in place of four, as we found it. We have also remodeled our steel top car to carry the additional material, and have built an extra skip of the increased size.

Our cage has been remodeled to conform to our safety rules.

When Mine was placed on one shift, we found we did not have enough tram cars, so we built 15 new ones, and all are now in work.

HOISTING PLANTS.

Six hoists were at work when the Mine was taken over, and these have now been reduced to three, - one for Pascoe Shaft and one each for cage and Skip at No. 9 Shaft.

The Pascoe Shaft hoist is a modern Sullivan machine, and is in first class condition. The others are old, but in good repair. On account of the great depth from which our product is hoisted, it keeps our machinery extremely busy to get same to surface on one shift.

BOILERS.

Two boiler plants are maintained; No. 5 and Central. The former contains three 100 H.P. B. & W. water and tube boilers, and the latter, four 100 H.P. Horizontal Tubular boilers. All boilers are in good condition and furnish ample power for our requirements.

ELECTRICAL EQUIPMENT.

Our Electrical Equipment consists of one A.C. General Electric Generator, 150 H.P. belt driven by a 16 x 42 Allis Corlis Engine, and one De Laval combination High and Low Pressure Condensing Steam Turbine, driving two K.V.A. Westinghouse Generators.

Only one of the above plants is in use at a time, - the other held as an auxiliary.

Electric power is used to operate:-

- 1. Mine pumps.
- 2. Pascoe Top Tram Plant.
- 3. Coal trams to Boiler Houses.
- 4. Shop Machinery.
- 5. Crushing and Screening Plant.
- 6. Feed Water Pumps.
- 7. Laboratory Crusher.
- 8. Lights for Village of Republic, Mine Buildings, and underground.

The equipment is in good condition and furnishes ample power for our needs.

BENEFIT CLUB AND HOSPITAL.

The Mine Club and Hospital are conducted somewhat different from our other mines. Here the men pay \$1.40 per month from which the Doctor is paid 70 cents, the Accident Benefit Fund 50 cents, and the Sick Fund 20 cents. The expense of maintaining the Hospital is paid from the 50 cents, as is also time lost from accidents. This seems to be satisfactory to the men and has been in force for a great many years.

We ascertained from records in the Republic Office that one half the original cost of the Hospital building was paid out of this Benefit Fund, and the balance by the Republic Iron Co.

This item has been made the subject of a special report by Mr. W.H.Moulton.

HOME GARDENING PRIZES.

We own a large number of dwellings, and also have a great number of lease holders on Mine property, and we would like very much next year to start prizes for gardens, best kept premises, etc., such as are in force at some of our other mines. We are very much in favor of this kind of work and know the results fully compensate for the time and expenditures made.

SHIPMENTS.

Our shipments for the year have been very light, a total of 47,457 tons having been forwarded to the following points:-

			BESS	DMER	В	ASIC	TOTAL
	COL		LUMP	CRSHD	LUMP	CRSHD	
Tons	to	Dock,	372	2181	23852	9336	35741
	**	Algoma Steel Corporation					
		(All Rail)			7886		7886
11	**	Commonwealth Steel Co.(All Rail)			1504		1504
#	**	American Steel Foundries"			380		380
	**	Falk Company, "			48		48
**	11	Lake Superior Iron &					
		Chemical Co. "				1801	1801
**	11	American Car & Foundry "					
		Co.			48		48
"	"	Prime Steel Co. "			49		49
-		TOTALS	372	2181	33767	11137	47457

We have been shipping Basic Lump to the Algoma Steel Corporation, All-Rail, at the rate of ten cars per week, since shipments to dock were completed and our screening plant shut down, and have been selecting this Lump ore underground in place of picking it from stockpile, as had been the previous practice here.

This selecting is done underground without any additional expense over regular contract filling. The cost for picking this from stockpile has been upwards of 25¢ per ton. This we now save.

In additiona to shipments shown above, we forwarded from Mine and placed in stock at Presque Isle 5,533 tons Bessemer and 7,039 Basic Crushed Ore, which was screened from product in getting Lump to fill contracts.

Shipments were started over the Chicago Milwaukee & St. Paul Railway, but REPUBLIC MINE.

later an arrangement was made whereby a joint rate was put in force between the Lake Superior & Ishpeming and the Chicago & Northwestern Railway Companies, which permitted our ore to be taken in L. S. & I. Ry. cars by the Northwestern and turned over to the L. S. & I. Ry. at Ishpeming, and handled over the latter's dock at Presque Isle. This arrangement will, no doubt, work out all right when shipments are regular and up to the maximum, but during the past season, considerable delays were experienced on account of car supply.

During the past season, we have shipped our product over the various roads as follows:-

Chicago	& Northweste	rn Ry.Co.		9,558 t	ons
		" & L.S.&I Ry.Co.		# 28,322	
	Milwaukee	& St. Paul Ry. Co.		11,966	
Duluth,	South Shore	& Atlantic Ry. Co.		9,688	."
			TOTAL	60-034 +	tons

Includes 12,577 tons to Presque Isle Stockpile.

ANALYSIS AND MIXING OF ORES.

We have had but little opportunity to develop a "Mixing Mixture" during the past season, as practically only Basic Lump Ore was shipped. Our ores are of such a character that it is quite possible to make such grades as can be figured from our regular analysis. We are of the opinion that very satisfactory results could be obtained by making one straight grade of Crushed ore. This might be used to advantage as a "Sweetening Mixture" for Cliffs Shaft Ore, providing sales could be made that way.

Republic Mine ores when exposed to the air become more friable and break up in handling, which causes trouble and complaints when trying to ship screened Lump.

Following is a statement showing the analysis of our product and shipments for past eight months, viz:-

ANALYSIS OF PRODUCTION.

EIGHT MONTHS, MAY TO DECEMBER, BOTH INCLUSIVE.

	BESSEMER ORE.		BAS	BASIC ORE.			PASCOE ORE.		
1914.	TONS.	IRON.	PHOS.	TONS.	IRON.	PHOS.	TONS.	IRON.	PHOS.
May,	3496	66.80	.041	3664	65.02	.070			
June,	4432	66.80	.041	2417	65.02	.070	1354	57.51	.049
July,	4111	66.48	.042	4824	63.52	.066	341	58.26	.048
Aug.	4343	67.24	.044	3176	64.02	.073	2517	56.58	.049
Sept.	4994	67.31	.034	3144	65.80	.082	2155	56.90	.055
Oct.	4058	66.91	.044	3819	66.22	.071	2973	57.86	.049
Nov.	3323	66.25	.040	3582	65.33	.060	3106	58.63	.049
Dec.	5096	66.51	.041	3036	65.79	.068	3213#	57.75	.047
TOTAL	33853	66.80	.041	27662	65.02	.070	15659	57.51	.049

Total average all ores, Run-of-Mine, 77174 64.29 .053

It will be noted that should all of our production have been mixed and shipped as one grade, a good average would have been secured.

AVERAGE ANALYSIS OF SHIPMENTS.

EIGHT MONTHS, MAY TO DECEMBER, BOTH INCLUSIVE.

Bessemer Crushed, 2,181 64.96 .036 Basic Lump, 33,766 65.51 .062 Basic Crushed, 11,138 63.00 .068 TO PRESQUE ISLE STOCKPILE. Bessemer Crushed, 5,538 63.07 .040	Bessemer Lump,	372	67.17	.046
Basic Crushed, 11,138 63.00 .068 TO PRESQUE ISLE STOCKPILE. Bessemer Crushed, 5,538 63.07 .040		2,181	64.96	.036
TO PRESQUE ISLE STOCKPILE. Bessemer Crushed, 5,538 63.07 .040	Basic Lump,	33,766	65.51	.062
TO PRESQUE ISLE STOCKPILE. Bessemer Crushed, 5,538 63.07 .040	Basic Crushed.	11,138	63.00	.068
	Bessemer Crushed.	5.538	63.07	-040
Basic Crushed, 7,039 63.06 .069	Basic Crushed,	7,039		
	Avg. Analysis of Total,	60,034	64.53	047

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SORTING ORE.

This is a source of heavy expense at all times both underground and on surface. We have at present 14 men picking rock underground and three on surface.

The ore, as it stands in place, is practically free of rock, but as the stopes are carried up and pulled, the walls slab off and become mixed with the ore in the stope and must be separated as the ore is being won.

In Pascoe Shaft this is particularly bad, as the walls there are composed largely of Soaprock, which breaks up fine and is difficult to separate.

A picking belt has been authorized for No. 9 Shaft, which will permit us to pick the rock on surface, where it can be handled to the best advantage. A picking belt will also be necessary at our Pascoe Shaft, and recommendations for this will be made as soon as we gain some experience in the operating of the proposed one at No. 9 Shaft.

This rock sorting problem is of vital importance here, as it is quite a fight to secure anywhere near a clean product.

MINE TIMBER.

The supply of timber here is purchased from local jobbers and an adequate supply can be secured at reasonable prices.

Under our present system of mining, the amount of timber to be used will not be as great as heretofore.

PERSONAL INJURIES.

We regret to have to report one fatal accident during the period we have been operating the Mine, Accident Report No. 50, Peter Kostamo was killed and his partner, Edmond Durante, severely injured, on October 14th, in Stope No. 7, Pascoe Shaft, by a fall of ground. These men were trimming the back of their stope and barred loose a small chunk which proved to be the "key" holding a much larger one that fell, burying Kostamo and injuring Durante.

On October 6th, Chester Nelson, a miner in Stope No. 1, 2050' level, Pascoe Shaft, had his leg broken by a chunk of Soaprock which slabbed off the wall back of him.

We have had numerous minor accidents, most of which are caused by chunks rolling down the dirt piles and fillers getting their hands and feet injured.

We hope to make a better showing under this head during the coming year.

STOCKPILE BALANCES.

Our balances in stock as of December 31st, 1914, are as follows;-

		TONS.		
	BESSEMER	BASIC	PASCOE	TOTAL
No. 8 Shaft,	1,531			1,531
No. 9 Shaft,	8,601		52,035	60,636
Pascoe Shaft,	27,565	5,961		33,526
Presque Isle Stockpile,	5,538	7,039		12,577
TOTAL TONS,	43,235	13,000	52,035	108,270

LABOR.

The character of our organization as a whole is very good and excellent service is being rendered. Practically all of the men now employed are men of family, and most of them have been at the Mine a great many years; some of them practically all their working lives, having been born and raised in Republic.

The average age of our men, I presume, is somewhat higher than the general average.

On October 1st, a reduction of 10% in wages was put in effect.

Placing the Mine on day shift, only, reduced the surface force somewhat, but further reductions have been made in order to care for the work on a proper basis. Following is a comparative statement of the classification of surface labor at the time we took over the Mine and as at present, viz:-

		NO. MEN	
	MAY 1914.	DECEMBER 31,1914.	REDUCTION
Engineers & Brakemen,	13	8	5
Firemen & Coal Men,	6	5	1
Carpenters,	6	6	
Blacksmiths & Helpers,	9	9	
Machinists & Helpers,	5	4	1
Landers,	8	3	5
Teaming & Trucking,	8	3	5
ffice & Warehouse,	3	3	
Laboratory & Samples,	3	2	1
Timber Framers,	2	0	2
Janitor,	1	1	
Trackman,	1	0	1
Electrician, Oiler & Ropeman,	3	1	2
Steam Shovel,	3,	0	3
Crusher,	3	0	3
Dry Houses,	4	2	2
Picking Rock,	3	3	
Watchman,	0	1 (Increase	9)
Chain Gang,	10	3	
TOTAL,	91	54	38

The above shows we have added one man, Night Watchman, and have reduced the force 37 men. It will be necessary, of course, to increase our present force when shipping season opens, to the extent of Steam Shovel and Crushing plant crews.

LABOR. (CONTINUED)

Our underground forces have been re-arranged, to advantage, as is shown in the following comparative statement between May month and December month, viz:-

	MAY MONTH	DECEMBER MONTH	DECREASE	INCREASE
Captains & Bosses	10	7	3	
Cage Riders & Skiptenders	7	5	2	
Pipemen & Trackmen	2	4		2
Timbermen	11	11	0	497
Puffermen	4	3	1	
Pumpmen	3	2	1	
Laborers	67	18	49	
Miners	74	80		6
Trammers	37	34	3	
Rock Pickers	13	14		1
Bucket Landers (Shaft)		2	0 1 1 49	2
TOTAL	228	180	59	11

It will be noted ffrom above that we are employing an increased number of miners (who perform the actual work underground) and our greatest saving has been in cutting off a large crowd of floating laborers.

The above saving in labor both on surface and underground is reflected in our production per man, which shows large gains and at the same time, our tons per day also have largely increased as will be noted by the following statement, viz:-

TONS PER MAN AND PER DAY.

	PRODUCT	TONS.	TONS PER	MAN PER I	AY.
1914.	TONS.	PER DAY.	SURFACE	U.G.	TOTAL.
May	7,160	448	4.39	1.85	1.25
June	8,203	328	4.30	1.78	1.26
July	9,276	357	4.98	1.96	1.40
Aug.	10,036	386	4.78	2.13	1.47
Sept.	10,293	403	4.52	2.29	1.52
Oct.	10,850	402	5.50	2.29	1.62
Nov.	10,011	435	6.42	2.40	1.68
Dec.	11,345	454	6.93	2.49	1.83

LABOR. (CONTINUED).

The above increases have been secured notwithstanding the large number of men employed on repairs to Water Power Plant, etc.

Due credit is hereby given to the organization at the mine. We seem to have the hearty co-operation of every man on the job, and they have responded gladly to our demands upon them.

Particular mention is made of our office force, who, during the few months' experience with our system of accounts, have so familiarized themselves with same, that their work already will compare most favorably with any of the other mine offices.

ESTIMATE OF PRODUCTION.

Our estimate of Production for the next 12 months is 300 days @ 500 tons per day - 150,000 tons.

COST, PRODUCTION, ETC.

The following statement shows the results secured each month during the eight months, May to December, both inclusive.

It will be remembered that our Company did not take over the Management of the Mine until June 1st, and May month figures are the results of the previous operators.

The following figures include all expenditures for the improvements made including work on Water Power Plant, Michigamme Dam, building new skips, new cars, etc., etc.

COST, PRODUCTION, ETC.

MONTH.	PRODUCT	NUMBER MEN			TONS PER	TONS PER
	TONS.	SURFACE	U.G.	TOTAL	DAY	PER DAY.
May	7,160	92	228	320	448	1.25
June	8,203	72	185	257	328	1.27
July	9,276	71	186	257	357	1.41
Aug.	10,036	81	182	263	386	1.46
Sept.	10,293	87	179	266	403	1.52
Oct.	10,850	73	175	248	402	1.62
Nov.	10,011	73	180	253	435	1.68
Dec.	11,345	65	180	245	454	1.83

	LAB	OR STAT	EMENT.	COST SHEET			
MONTH	LABOR COST PER TON.			COST			
	 SURFACE	U.G.	TOTAL.	LABOR.	SUPPLIES.	TOTAL	
May	.705	1.428	2.133	2.098	.704	2.802	
June	.576	1.523	2.099	2.141	.735	2.876	
July	.514	1.383	1.897	1.948	.974	2.922	
Aug.	.531	1.289	1.82	1.838	1.014	2.852	
Sept.	.561	1.192	1.75	1.733	.708	2.441	
Oct.	.427	1.078	1.505	1.542	.708	2.250	
Nov.	.410	1.033	1.443	1.480	.809	2.289	
Dec.	.339	.998	1.337	1.371	.653	2.024	

Cost of Production for December month is 28% less than May month.

It will be noted from above that our labor costs show a material decrease, but our supply charges continue high. The Supply Costs are high on account of the large amount of material purchased for Water Power Plant, drill steel, etc. Our Fuel consumption has also been high on account of having to make all our air with steam. As soon as our Water Power is in operation, our supply costs should also come down.

The lower labor costs have been secured by the introduction of different mining methods underground, the handling of product on surface, and the cutting off of unnecessary labor, both underground and on surface. It will be noted that surface labor costs per ton have been reduced over 50% in December, and underground labor 30%, as compared with May month.

COST, PRODUCTION, ETC.

The following statement shows a comparison between May and December Cosrs per ton on each Mine Account and the precent increase or decrease, viz:-

MO. ACCOUNT. MAY DECEMBER INCREASE. DECREASE.	
GENERAL EXPENSE. 26 Insurance, .000 .006 .006 27 Engineering, .037 .012 .025 28 Analysis, .017 .010 .007 29 Mine Office, .153 .066 .087 30 Personal	
26 Insurance, .000 .006 .006 27 Engineering, .037 .012 .025 28 Analysis, .017 .010 .007 29 Mine Office, .153 .066 .087 30 Personal	
27 Engineering, .037 .012 .025 28 Analysis, .017 .010 .007 29 Mine Office, .153 .066 .087 30 Personal	
28 Analysis, .017 .010 .007 29 Mine Office, .153 .066 .087 30 Personal	
29 Mine Office, 3153 .066 .087 30 Personal	
30 Personal Injury, .000 .017 .017 TOTAL .207 .111 .096 December Decrease MAINTENANCE. 125 Trks.& Yds037 .005 .032 126 Dks.,T.&Pkts003 .008 .005 127 Buildings, .020 .004 .016 128 Shop Mchy000 .008 .008 129 Boiler Plant, .011 .003 .008 130 Hoist.Mchy149 .014 .135 131 Cmmp.&P.D000 .001 .001 132 Pump.Mchy005 .008 .003 133 Top Tram Eng.	
Injury,	
MAINTENANCE. 125 Trks.& Yds. 126 Dks.,T.&Pkts. 127 Buildings, 128 Shop Mchy. 129 Boiler Plant, 130 Hoist.Mchy. 149 131 Cmmp.&P.D. 132 Pump.Mchy. 135 Cars, 200 134 Skp.& Skip Roads, Roads, 135 Crusher & 136 Crusher & 137 Tel.&Safety Devices, 1037 1005 1005 1005 1005 1005 1006 1006 1006 1006 1007 1007 1008 1008 1008 1008 1008 1008 1008 1008 1008 1008 1008 1008 1008 1008 1008 1008 1008 1009 1001	
MAINTENANCE. 125 Trks.& Yds	
MAINTENANCE. 125 Trks.& Yds	
126 Dks.,T.&Pkts003 .008 .005 127 Buildings, .020 .004 .016 128 Shop Mchy000 .008 .008 129 Boiler Plant, .011 .003 .008 130 Hoist.Mchy149 .014 .135 131 Cmmp.&P.D000 .001 .001 132 Pump.Mchy005 .008 .003 133 Top Tram Eng. & Cars, .000 .014 .014 134 Skp.& Skip Roads, .013 .045 .032 135 U .G.T.&Cars, .025 .029 .004 137 Tel.&Safety Devices, .009 .007 .002 138 Crusher &	
127 Buildings, .020 .004 .016 128 Shop Mchy000 .008 .008 129 Boiler Plant, .011 .003 .008 130 Hoist.Mchy149 .014 .135 131 Cmmp.&P.D000 .001 .001 132 Pump.Mchy005 .008 .003 133 Top Tram Eng.	
128 Shop Mchy	
129 Boiler Plant, .011 .003 .008 130 Hoist.Mchy149 .014 .135 131 Cmmp.&P.D000 .001 .001 132 Pump.Mchy005 .008 .003 133 Top Tram Eng.	
130 Hoist.Mchy149 .014 .135 131 Cmmp.&P.D000 .001 .001 132 Pump.Mchy005 .008 .003 133 Top Tram Eng.	
131 Cmmp.&P.D000 .001 .001 132 Pump.Mchy005 .008 .003 133 Top Tram Eng.	
132 Pump.Mchy005 .008 .003 133 Top Tram Eng.	
133 Top Tram Eng.	
& Cars, .000 .014 .014 134 Skp.& Skip Roads, .013 .045 .032 135 U .G.T.&Cars, .025 .029 .004 137 Tel.&Safety Devices, .009 .007 .002 138 Crusher &	
134 Skp.& Skip Roads, .013 .045 .032 135 U .G.T.&Cars, .025 .029 .004 137 Tel.&Safety Devices, .009 .007 .002 138 Crusher &	
Roads, .013 .045 .032 135 U .G.T.&Cars, .025 .029 .004 137 Tel.&Safety Devices, .009 .007 .002 138 Crusher &	
135 U .G.T.&Cars, .025 .029 .004 137 Tel.&Safety Devices, .009 .007 .002 138 Crusher &	
137 Tel.&Safety Devices, .009 .007 .002 138 Crusher &	
Devices, .009 .007 .002 138 Crusher &	
138 Crusher &	
141 W.P.Repairs, .000 .104 .104	
TOTAL .291 .250 .041 December	. Net
Decrease	
MINING EXP.	
150 Air Pipes, .010 .013 .003	
151 Comprs028 .115 .087	
152 Hoisting, .354 .149 .205	
153 Pumping, .059 .042 .017	
154 Snkg.&S.Rprs027 .120 .093	
155 Rock Drfting, # .278 .087 .191	
156 Breaking Ore (.648 .640 .008	
157 Tramming, .297 .226 .071	
158 Filling, .127 .016 .111	
159 Timbering, .162 .074 .088	
160 Capt.&Bosses, .106 .062 .044	
161 Dry Houses, .049 .018 .031	
162 Top L.&T051 .015 .036	
163 Stokng.Ore .002 .006 .004	
164 Sorting Ore, .082 .079 .003	
Stocking at P.Isle .000 .001 .001	
Screening, .025 .000 .025	
TOTAL, 2.304 1.663 .641 December	Net . 27.8%.
GRAND TOTAL, 2.802 2.024 .778 December	
crease (

[#] Drifting in ore included in rock drifting in May month.

CHARTS.

The following two charts "A" and "B" give a comparative view of some of the main items of costs, etc., at the Republic Mine for the past forty-two (42) years, in so far as we have been able to secure same from the records, viz:-

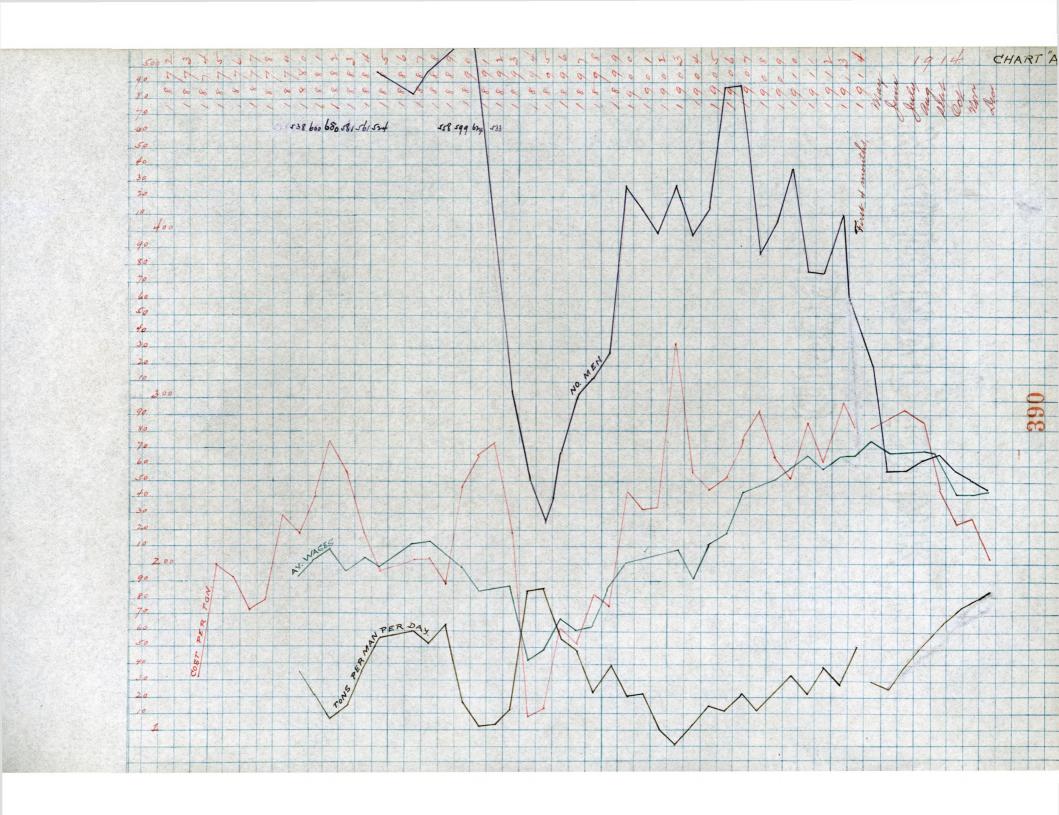
CHART "A":-

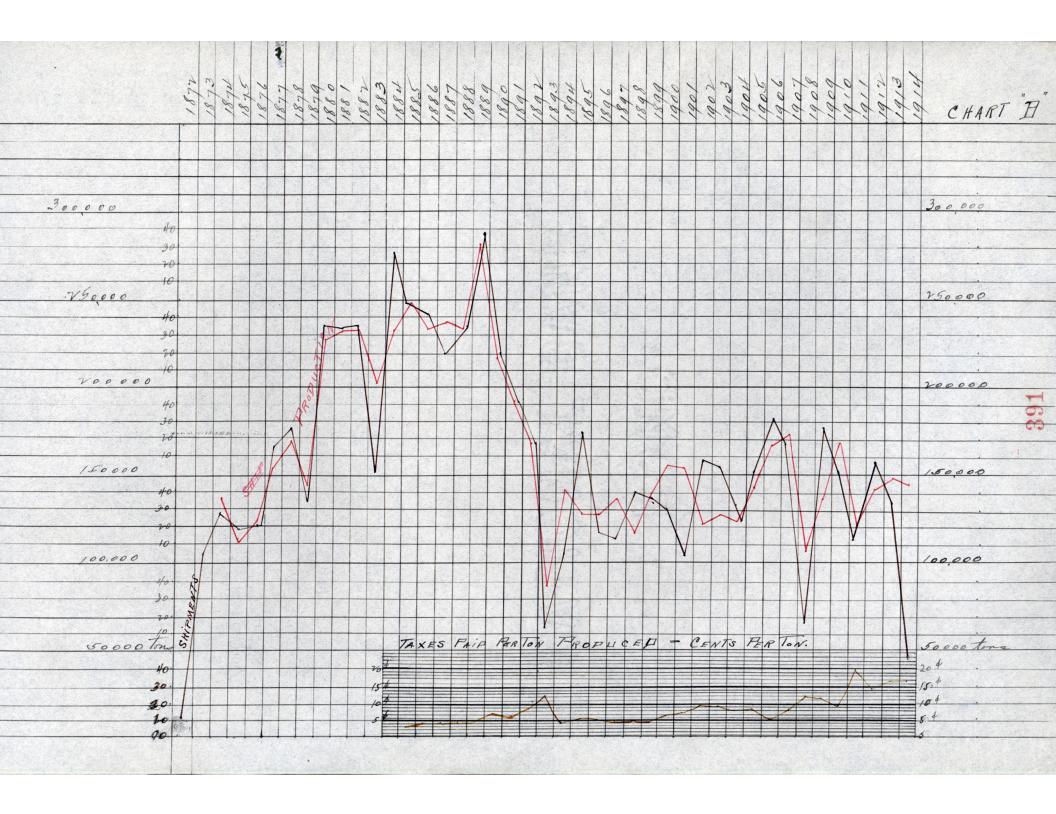
- 1. Cost per ton each year since 1874.
- 2. Average Daily wages each year since 1880.
- 3. Average number of men each year since 1880.
- 4. Average tons per man per day each year since 1880.
- 5. Cost per ton and tons per man per day each month, May to December, 1914, both inclusive.

CHART "B":-

- 1. Yearly shipments each year since 1872.
- 2. Yearly production each year since 1874.
- 3. Taxes paid per ton produced each year since 1885.

These lines are most interesting and particular attention is called to the two lines covering the work of the past eight months. When these are compared with the years previous, it will be noted that same have not met since 1896, eighteen years ago. We hope to have the "tons per man" line appear above the "Cost per ton" line very shortly.





TAXES.

On account of the high valuation placed upon the Mine by the State Tax Commission, cur Taxes are exceptionally high, especially per ton on ore shipped.

REPUBLIC MINE TAXES.

	1910.	1911.	1912.	1913.	1914.
Valuation,	581,760.	1180,456.	1131,413.	1264,090.	1156,399.
Rate Percent,	3.23	2.12	1.78	1.84	1.80
Taxes,	18779.25	24966.66	20184.39	23322.44	20815.18
State,	1745.28	3458.75	2127.05	3994.51	2231.84
County,	3490.56	4485.73	2489.11	2983.23	3110.72
Township,	989.01	1180.46	1335.08	1238.82	1202.64
Road Repair,	639.92	826.33	667.54	619.40	601.32
School & 1 Mill,	8493.70	10978.23	10182.72	11111.36	10419.15
Highway,	1279.87	1558.22	1335.04	1238.82	1191.08
Water Bond,	861.04	1534.57	1269.16	,1150.31	1075.49
County Road	1279.87	944.37	780.69	985.99	982.94
Collection Fees,	187.79	249.67	201.85	233.23	208.15
TOTAL TAXES,	18967.04	25216.33	20386.24	23555.67	21023.33
Product-Tons,	169,219	120,089	142,322	148,102	124,920
Taxes per ton Product,	.112	.209	.143	.159	.168
Shipments-Tons,	150,423	113,012	158,051	135,879	47,457
Taxes per ton Shipped,	.126	.223	.129	.173	.443

TOWNSHIP LIGHTING.

At the time we took the Mine, electric current was being furnished the town for lighting purposes at the rate of 3¢ per K.W.H., and paid for on the basis of individual meter readings. We have installed a meter on our switch board and our charge is now based on its readings, thereby compensating us for the total amount of current consumed including line losses.

No extra labor is necessary to furnish this service, and the only cost to us is the additional coal to produce the extra current.

The town owns the power lines and equipment and takes care of all repairs and the selling to and collecting from consumers.

The street lighting consists simply of fifteen 100 K.W. lamps hung at street intersections in main part of town. These street lights were installed in September month this year.

STEAM SHOVEL.

Our Steam Shovel is old and in very bad repair, and our cost per ton for loading was exceptionally high during the past season.

The machine has not power enough to begin with, and makes hard work of digging in ore. We should have a new machine this coming season, and the matter has been referred to the Mechanical Department.

During the season, we added an Ashland steel dipper lip and a set of Ashland rail clamps to the equipment.

FARM.

The Mine has about 63 acres cleared and under cultivation. Hay is the crop raised, but during the past season a part of the land was planted to oats, but no crop harvested, as same was ruined by a severe rain storm in July month.

Part of the land fenced by the Republic Iron Company is owned by Mr. Jacob Scholzen, a citizen of Republic. This was due to the fact that the lines were not surveyed at this point. We have had a survey made and adjustment will be made with the claimant.

During the past season we harvested 28 tons Hay and 4 tons straw from the land, and in addition, sold part of the standing hay for one hundred dollars.

SAFETY WORK.

Same attention has been given this subject by the previous operators, especially in the Machine Shop, but we found a great many places where considerable work was necessary to bring the property in line with our Safety Rules requirements. A number of these remain incomplete, but are being given attention as rapidly as possible.

In addition to installing guards, etc., we have provided a set of five two-hour Rescue Helmets and a Pulmotor.

A Mine Rescue and First Aid crew is being given regular training, and we look for good results from this work.

LEASED LOTS.

We have a total of 305 pardels of ground used by tenants, on a large number of which, dwellings have been erected.

Our Surface Map showing these, has just been completed and we will proceed to cover same with leases, duly executed.

The Mine also has a certain acreage fenced for pasture, and this is rented to different parties during the summer months.

WATER POWER AIR COMPRESSORS.

This equipment consists of two 2500 ft. Ingersoll-Sargent Piston Inlet Machines, rope driven from two water turbines.

The plant is located on the Michigamme River about 4700 feet from the Mine, and the air is conveyed through a 16" steel pipe.

During the winter months, not enough water has been available to drive both of these compressors and the additional amount of air necessary has been made with a steam driven machine at the Mine. During the summer, the dam at Lake Michigamme was repaired and raised and we hope enough storage has been secured to provide ample water during all of the year.

On June 9th, a piece of the Inlet Valve on one of the compressors broke off and dropped down into the cylinder and was jammed against the head by the piston, injuring the latter to such an extent that it was necessary to install a new piston.

In July month, one of the turbines was wrecked. This was due to the bulkheads and foundations being in extremely bad repair.

On October 17th, the Water Power Plant was shut down for repairs and since that time, all air used has been made by steam power. The entire water end of this water power plant has been completely rebuilt and a new and larger turbine ordered to replace the one broken. Up to December 31st, we have expended \$4,626.06 on this work, and same is now complete, except to install the new wheel when received.

The 16" main air line from this plant to the mine was repainted during the summer and the carrying stands repaired, which places this instrument in good condition.

UNDERGROUND.

GENERAL.

At the time the Mine was taken over, underground conditions were excellent. Drifts and levels well lighted, tracks in good shape, a sufficient number of drill machines on hand, ventilation good and matters generally very satisfactory.

ORE BODIES.

The ore bodies in the Republic Mine are irregular in form, commencing as a rule, on the the contact with the hanging quartzite and falling back to and into the footwall Jasper, where they die out. The lenses are sometimes two or three feet wide and run from that width to fifty feet in places and are at times several hundred feet thick, extending through several levels.

The ore bodies in the vicinity of No. 1 and Pascoe Shafts have, in places, a Soaprock hanging and foot, which does not stand well in place and tends to slab off as stopes are being advanced or pulled.

The condition of the ore bodies on the bottom of the mine present an excellent showing in Pascoe Shaft, but no ore is in sight on the bottom level (1935') of No. 9 Shaft, where explorations are underway. Drifting has been in progress here during the past eight months, endeavoring to locate the ore which was supposed to be coming down from the 1815' level, but to date, only a few small lenses have been cut. It appears that the large ore body on the level above has "cut out" and that new lenses coming in below must be looked for.

SYSTEM OF MINING.

The mine has of late years been worked on a modified shrinkage stope system. The plan has been to drive the main level into and through the ore body; then stope it up a distance of 15 or 16 feet for the full width of the ore, then closely timber the whole area with stull timber and start stoping, breaking the ore down upon the timber, drawing off only enugh to give head

room in the stope for mining, until the stope was completed through to the level above or to the ore limits, after which the ore was drawn as rapidly as required and the stope cleared out.

With this system it was found that the timbering at the bottom of the stope became decayed before the stope was completed and, in spite of numerous and costly repairs, the drifts could not be maintained in supporting the heavy load of ore.

On the 1815' level, No. 9 Shaft, the method was modified and a drift has been driven along the stope, back in the rock, and "drawing places" punched through to the stope from which the ore is drawn and shoveled into cars.

Immediately upon taking charge of the Mine, we commenced opening new stopes by putting up raises 20 feet apart, in the ore, and starting our stopes, after leaving a back of solid ground to protect the drift, drawing off the ore through chutes at the bottom of the raise. This has worked out satisfactorily in all but a few cases. There have been a few stopes, where the walls were composed of Soaprock, that did not stand very well and the pillar started to slab off. We overcame this trouble by slipping in a few sets of timber to hold the ground.

It will be necessary for us to complete the mining and drawing of the stopes being operated at the time we took over the Mine in the way they were started, but all new stopes will be wrought in the new way unless even better methods suggest themselves.

The method of carrying the stopes on stulls seems to us to be exceptionally unsatisfactory, especially when the breaking of the ore in a stope has been completed and is filled. Take for instance the 1665' level, No. 9 Shaft, where we found 82,200 tons broken on timber and stopes completed where there was room for but two gangs of trammers to work. The way we are now working gives us more drawing places and will permit the stope to be rapidly cleaned when completed.

We were told that this system of raises and chutes could not be

worked here, but we present the results already secured after the few months' trial they have been given as ample proof of the adaptability of the method.

ROCK .

It is necessary to handle an enormous quantity of rock in our operations, and where possible, this is dumped into old workings underground.

We report daily only the rock hoisted and during the eight months we have been here, a total of 30,543 tons have been hoisted, which is equal to 40% of our ore hoist during the same period. In addition to this, we have handled and dumped underground an additional 35,767 tons, so it can readily be seen that this item is a heavy burden to carry.

SORTING ORE.

This is one of the main items entering into the difficulty of winning the ore at the Republic Mine.

The cre, as it stands in place, is practically free from rock, but through most of the ore bodies "horses" of Jasper project themselves, these in places, take the shape of wedges coming down into the ore from above. In order to mine the stope, it is necessary to take down this Jasper which, of course, becomes mixed with the ore. In addition to these horses of Jasper, the Quartzite hanging slabs off as the stopes go up and are cleaned out. In the territory of Nos. 1 and Pascoe Shafts, the Scaprock walls also slab off and enormous quantities of rock become mixed with the ore in the stopes.

In some of the stopes, it is estimated that as much as 50% of the broken material is rock.

In tramming from these stopes, this mixed material comes down and rock-pickers are stationed at every car to sort the rock from the ore. The rock is stored in the drifts until a car load has been accumulated and is then picked up, trammed to the Shaft, and hoisted. At times more rock than ore is encountered and the process of picking is reversed - the ore is sorted from the rock and is afterwards picked up and hoisted. A picking belt seems to be the only solution to this problem.

SHAFTS.

Five shafts were in operation when the Mine was taken over,

Nos. 1, 6, 8, 9, and Pascoe. We are at present confining our work to two,

No. 9 and Pascoe.

No. 1 Shaft does not come through to surface and the cre had been hoisted up this shaft to the 1153' level and trammed across to No. 8 Shaft, where it was brought to surface. We stopped this and now take the ore over to Pascoe Shaft on the 1570' and 1640' levels and to surface through that shaft.

Old floors and pillars around old No. 6 Shaft are being mined and at the time we took the Mine, the material was brought to surface through No. 8 Shaft. We have changed this and are taking the ore through No. 9 Shaft.

No. 6 Shaft is an old shaft with its collar at the bottom of the large open pit and the material was hoisted in a bucket operated on an aerial tram. This we found was not a paying operation and same was closed down.

Our hoisting operations have been concentrated and a large source of expense, maintaining shafts, hoists, etc., h has been eliminated, which is reflected in our cost sheets.

We found the top section of Pascoe Shaft in extremely poor condition, due to the decaying of the timbers, and during July month, this was re-timbered for a distance of over 50 feet. Steel I beams with concrete lath were used in the hanging and the west side was close timbered with Tamarack legs and backed with concrete lath. The east side was close timbered with Tamarack. All timber was treated with a preservative paint before being put in place.

Pascoe Shaft is 3400' deep on the incline, some portions being timbered and others are in solid rock, requiring no timber. The shaft is old and running at different degrees of dip, requires constant attention. An inspection is made of this shaft every working day and numerous repairs are necessary. The rope carrying sheaves alone are quite an item, there being over 200 of these in work in this shaft.

LOADING APRONS.

All tram cars dump directly into the skips and at Pascoe Shaft two heavy wood boards were used on the skip to prevent some of the material being dumped from falling into the shaft. In order to place these boards, the tender must let down a platform into the center of the shaft on which to stand. This was a slow and dangerous operation, and we have installed steel aprons at all the hoisting levels, in this shaft, to replace same.

The skips have been loaded with the old boards for upwards of 30 years without accident, but shortly after we had planned the proposed improvement and before the work started, one of the tenders fell off the platform into the shaft, fortunately without serious injury.

BREAKING ORE.

The clost of breaking ore is unusually high, due to the large amount of rock that it is sometimes necessary to break with the ore.

The ground drills nicely, but a large amount of powder is necessary to break it, especially in drifting or raising, which makes our cost per ton for powder very high.

TIMBERING .

We do not expect our timber cost to be as high during the coming year as it has been during the past, as not as much still timber will be used. It will, of course, be necessary to use a large amount of heavy cribbing in maintaining our mills and chutes.

UNDERGROUND LABOR.

This item has been largely decreased as will be noted from classification of underground labor. Laborers were used nto assist the miners in handling the dirt in the stopes, etc; there was no apparent reason for this and we, therefore, eliminated it entirely.

MINE WATER AND PUMPS.

Our flow of water is very small underground, and we pump approximately 100 gallons per minute.

Pumps are of small capacity and are driven by electric power. Two pumping systems are maintained - one in No. 9 Shaft and one in Pascoe Shaft.

In No. 9 Shaft, one pump on the 1935' level throws the water to the 1665' level, where another pump sends it to the 1153' level, where still another pump relays it to surface. At Pascoe Shaft, a small air pump throws the water from the 2050' level to the 1950', where an electrical pump sends it to the 1223' level, where another electrical pump sends it to surface. A lot of machinery for such a small volume of water.

NO. 1 SHAFT.

1570' LEVEL; 1640' LEVEL;

The work in this territory consists of filling old stopes and removing floors and pillars of ore left by previous operators.

The product from here is being taken through Pascoe Shaft, and all rock handled is dumped into old rooms underground.

During the eight months, 9,833 tons were mined from this territory, and in winning same, 10,886 tons rock were handled.

There is a considerable tonnage of ore remaining in these old floors and it is questionable whether they can be mined at a profit on account of the large amount of filling necessary. Each floor will be made and the subject of close figuring before work will be commenced on same.

NO. 8 SHAFT.

911' LEVEL;

The work in this territory consists of taking old floors and pillars around old No. 6 Shaft. All rock encountered is dumped underground.

The ore from here is trammed across to and hoisted through No. 9 Shaft.

This Shaft (No. 8) has been abandoned and has been stripped of ladders,
rails, pipes, etc.

NO. 8 SHAFT (Continued).

During the eight months, 6,859 tons ore was won from this territory and 24,881 tons rock were handled. Most of this rock was used to fill the large stope underneath this level. This work has now been completed and the floor is being taken on top of the filling.

NO. 9 SHAFT.

911' LEVEL:

This drift was equipped with a small "puffer" to draw the tram cars up a slight grade in bringing No. 8 ore to this shaft. The skiptender on this level also operates the puffer, so no additional expense is necessary.

During the year a large amount of rock was trammed from old stopes on this level and used to fill underneath the floor. Considerable ore was sorted from the rock, which helped to pay for the handling of the filling material.

950' LEVEL:

This is a new level which we opened in December month, 1914, to permit us to mine the floor of the 911' level. The large stope was being filled at the time we took the mine and this work of filling was continued by us and completed on December 1st, when the work of taking the floor commenced.

The ore available in this floor as estimated by our engineer is 14,400 tons and 5,000 tons tied up in the shaft pillar. This is all Bessemer ore and should be cheaply won.

During December month 1,020 tons were taken from here.

1665' LEVEL;

All the ore above this elevation was broken in the stopes at the time we assumed the management of the mine, and totaled over 80,000 tons.

No. 5 steps has been drawn back to near the 250' Meridian and operations have been discontinued until such time as the floor of this level has been mined from below. No more ore may be drawn from here until this has been done, as we must maintain the raise at this point for ingress and egress to the workings below.

NO. 9 SHAFT (Continued).

Nos. 2 and 3 footwall stopes have also been drawn back as far as permitted at the present time for the same reasons noted above.

A total of 72,130 tons remain charged to the stopes on this level and a large portion will be dropped through to the 1815' level where it can be more readily and rapidly attacked. About 40,000 tons of this ore is of low grade, running about 55% in iron and .062 in phosphorus and is badly mixed with rock.

At a point near the 100' Meridian, No. 4 stope, the floor has been mined through from below and the ore now goes down to the level below.

About 12,000 tons ore have been trammed from this level during the past eight months.

1815' LEVEL:

The carrying up of the hanging stopes in the ore above this level, was in progress when we came to the Mine on June 1st, and this work has been vigor-ously prosecuted with miners on both day and night shifts ever since.

About a month ago #1 and 2 hanging stopes were holed through to the level above and the taking of the balance of ore remaining in the floor of level is now underway.

The miners in Stope #3, South end, are now up close to where they will break through and remove the floor of the level above, but it will take eight or ten months to complete the work to the North in this stope.

All of the ore, now broken on this level, is being carried on stulls, which we hope will live until all the ore has been broken above, when it is proposed to abandon this timbered drift and draw off the ore through drawing places driven in from the footwall drift.

We started in June month raising and stoping in the extreme North end of this level, using the method of leaving a back of solid ground to protect the drift. No work is being done at this point at present, as the ground is so lean it was impossible to keep our production up to grade when same was being taken.

NO. 9 SHAFT (Continued).

The work of raising and stoping without timber has also been underway in the ore above the footwall drift. We found at one point it was necessary to put in stills, as the ground would not stand in the pillars which had been left.

No. 1 footwall stope is a small body of good ore which has been mined clear through to the level above, and is now being cleaned out. All of the ore charged to this stope has been taken and an excess is being secured.

A total of over 90,000 tons is broken above this level, over onehalf of which is first class Bessemer, running 66% Iron and .045 Phosphorus. The balance is low grade, averaging slightly over 55% Iron.

15,254 tons ore was taken from this level during the time we have operated the mine.

1935' LEVEL:

We regret being unable to report any ore finds on this elevation. Drifting has been underway on both shifts all the year and no ore bodies have been proven. The drift from the shaft was extended to the hanging Quartzite after encountering a small bunch of ore near the 200' line. This was at first thought to be the main ore body coming down from above, but it proved not to be the case. We then started a drift Northwest from this and have gone a distance of 220 feet without results. A small stub was driven to follow a seam of rich looking material, but this did not encounter ore.

We have now started a cross-cut west from the end of the long drift with the plan to get out into the Quartzite a distance of about 100 feet, from which it is proposed to put down some drill holes to explore the ground below this level.

Raises will be put up to locate the ore which should be above this level.

No. 1 footwall stope is the same ore body encountered on the level above and is being carried up by one gang of miners. There is a total of 2,600 tons of first class Bessemer ore broken on stulls in this stope. A diamond

NC. 9 SHAFT (Continued).

drill hole shows some ore farther ahead of this stope and it appears now as though this would connect with this stope above the level.

Prospects are not good for ore on this level, but this should not be deemed discouraging as like conditions have at times been experienced, and it is quite possible that we are now in a barren area.

3,079 tons ore were taken from the footwall stope on this elevation during the eight months.

SHAFT SINKING.

No. 9 Shaft was sunk $128\frac{1}{2}$ feet during the past eight months, and the level station is now being cut, 147' below the 1935' level.

A pocket will also be put in on this level and drifting to the ore measures will not be commenced until we can get some information from the proposed diamond drilling on the 1935 level.

PASCOE SHAFT.

922' LEVEL:

All ore in sight on this elevation was broken on stulls at the time we took over the Mine, and during the past months, the work of cleaning it out has been underway.

The tonnage charged to this stope has been hoisted and an excess is now being secured, - very little remains.

This is our West Republic territory, and up to the time that property was purchased by the Republic Iron Company, a royalty of 25¢ per ton was paid upon the ore mined.

During the past months 1782 tons were secured.

1335' LEVEL:

This level was opened during the past year to find and develop the ore encountered in a drill hole. Two lenses of mixed ore were encountered about 150' West of the shaft, and were opened up by raises and stoping is now underway. The stope is now up about 30' above the level and the two lenses are now

PASCOE SHAFT (Continued) .

connected and a good sized body of ore is in sight. This is low in iron and it is questionable if this can be mixed into our regular Basic grade.

The main drift will be pushed ahead into West Republic territory, and we hope to be able to report further finds during the coming year.

We mined nearly 2,000 tons from this point since encountering the ore. All from development work.

1850' LEVEL:

One gang was at work on this level and they completed the cleaning of the ore in No. 5 Stope. There remains 11,750 tons of good Bessemer ore broken in stope No. 1, and 3,200 tons of broken ore is tied up in No. 3 stope back of the shaft.

One gang has been at work for the past two months taking the floor of the 1780' level above this elevation.

A rock drift is also underway on this level, being driven Southwest from behind the shaft to cut the ore coming up from below in No. 1 Stope West.

2030 tons ore were taken from this level during the past eight months.

1950' LEVEL:

This level is looking very good and a large product is being taken from here.

Stopes Nos. 1, 2, 3, and 4 have been completed and Nos. 6 and 7 are now being carried up. The latter two under the raise and pillar method. Both these stopes are looking good and No. 6 is widening as it proceeds upwards, and it has every appearance of extending through to the level above.

No. 7 Stope is Magnetic ore.

There are approximately 27,000 tons of ore broken in stopes on this level, and we took off over 13,000 tons during the past eight months.

2050' LEVEL:

This is the bottom level in Pascoe Shaft and a drift, No. 2 North, is

being driven on this elevation to connect with No. 9 Shaft. This drift was in rock until it reached the 3000' Meridian, where it encountered Magnetic ore and followed in this a distance of 85 Feet and then 50 Feet further in Specular cre. This ore body is now being developed by raise and pillar methods and after chutes have been placed, the drift will be continued towards No. 9 Shaft.

No. 2 South entered ore after we took the mine and is also being developed along the new lines and is looking good at this writing. The prospects are excellent for a large tonnage not only on this level but also below.

Stope No. 1 is being carried up except where it comes back of the shaft, where the ground must be left to protect the shaft pillar.

A drift, Contract No, 11, was being driven in rock South and West of the shaft, when we took the mine, to locate the ore coming down from stope No. 1 West. The ore has now been entered and is being developed.

The outlook at the bottom elevation in this shaft is excellent for a considerable tonnage, and the indications are that the ore stopes now being worked on this level, will also continue some distance downward.

9,361 tons ore was hoisted from this level during the past eight months.

DEVELOPMENT WORK.

The development work has not been prosecuted as rapidly as necessary during the past two years. In order to maintain our present product, we should have more ground opened.

It will be noted from the maps that all stopes are small and the tonnage secured from each is not heavy and new stopes must be in continuous development. Most places now being worked are rapidly nearing completion, and in order mot to work ourselves to an end, we must look ahead and commence sinking Pascoe Shaft another lift immediately.

We hope to be able to connect No. 9 and Pascoe Shafts after this lift has been sunk, and then take all ore from bottom of mine through No. 9 Shaft, which would permit us to take the ore which is tied up in Pascoe Shaft pillars.

ORE IN SIGHT.

Following is our estimate of ore in sight as of December 31st, 1914.

NO. 9 SHAFT.

LEVEL.	PILLARS & FLOORS.	IN PLACE.	PROSPECTIVE.	TOTAL.
911'	4,200			4,200
1000'	5,000	14,400		19,400
10501	10,000	7,500		17,500
1153'	5,400			5,400
1815'		56,880		56,880
1935'		5,730	59,440	65,170
TOTAL	24,500	84,510	59,440	168,550

PASCOE SHAFT.

LEVEL.	PILLARS & FLOORS.	IN PLACE.	PROSPECTIVE.	TOTAL.
1293'	2,300			2,300
1335'		2,340		2,340
13651	7,100			7,100
1570'	13,470	40,110		53,580
1640'	5,650			5,650
1710'	28,000			28,000
1780'	33,250			33,250
1850'	28,700	4,470		33,170
1950'	69,020	13,960		82,980
2050'	20,290	65,550	12,640	98,480
TOTAL	207,780	126,430	12,540	346,850

TOTAL.

LEVEL.	PILLARS & FLOORS.	IN PLACE.	PROSPECTIVE.	TOTAL.
911'	4,200			4,200
1000	5,000	14,400		19,400
1050	10,000	7,500		17,500
11531	5,400			5,400
12931	2,300			2,300
13351		2,340		2,340
13651	7,100			7,100
15701	13,470	40,110		53,580
1640	5,650			5,650
1710'	28,000			28,000
1780	33,250			33,250
18151		56,880		56,880
18501	28,700	4,470		33,170
19351		5,730	59,440	65,170
19501	69,020	13,960		82,980
2050	20,290	65,550	12,640	98,480
GRAND				
TOTAL	232,380	210,940	72,080	515,400

REPUBLIC MINE.

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ORE IN SIGHT (Continued).

It will be noted from the foregoing estimate of ore in sight the large area over which the tonnage is distributed and the relatively small proportion of "ore in place." These conditions do not make for low mining costs.

A large amount of rock filling will be necessary to mine the ore in the old floors and no doubt difficulties will be met when we come to remove the Pascoe Shaft pillars.

It would seem that the conditions of our ore bodies should be carefully explained to the Tax Commission this year, in order to have same properly valued. There is no question but what we are over-assessed at this property.

The Republic Iron Company returned over 1,200,000 tons to the Tax Commission as being "in sight" last year. This we have reduced to 767,180 tons, which includes ore broken on stulls. The largest difference in the two figures is on the ore between the 1815' and 1935' levels in No. 9 Shaft.

At this territory we have no ore in sight on the bottom of No. 9

Shaft, and development work must be kept going as rapidly as possible at this point, as well as in Pascoe Shaft, in order to endeavor to discover sufficient new ore bodies to insure adequate ore reserves, so that we may maintain an average production of such proportion as will permit of its being won at a minimum cost.

We hope to make a better showing under this head in our next annual report.

ORE ON STULLS.

Following is a statement of Ore on Stulls with the average analysis as of December 31st, 1914.

NO. 9 SHAFT.

			VALIABI	E.	PAS	ALIABLE UNT COE SHAFT I ABANDONED.	
LEVEL.	STOPE.	TONS.	IRON.		TONS.		PHOS
16651	#1,	3,550	64.00				
**	#2,	4,110	64.00				
**	#3, N. end,	5,130	58.00	THE RESIDENCE AND LABOUR.			
if	#3, S. "	8,750	62.00				
	#4,	10,950	65.00				
11	#5, S. end,	39,540	55.00				
1815	#1. Hang.N.&S.ends,		66.00				
1013	#2, "	45.400					
		6,800	65.25				
	#3, N. end,	19,400	55.50				
	#3, S. "	20,820	55.61				
п	#3, Extreme No.end,	1,350	56.43				
1935'	#1, Foot Wall,	2,600	65.50	.035			
	No.9 TOTAL,	168,500					
		PASC	OE SHAF	r.			
1710'	#3,				12,800	65.00	.075
1780'	#3,				18,900	66.00	.066
	#4,				3,100	64.00	.068
1850'	#1, N.end,	11,750	65.07	.151			
11	#3,				3,200	66.00	.087
1950'	#1,	1,680	64.00	.077	0,000		
"	#1, West,	15,400	67.00				
**	#4,	2,000	66.00				
#	#6,	2,700	67.25				
	#º,		69.35				
		4,500					
2050	#1, West,	3,500	67.11				
	#1, North,	1,300	68.18				
	#2, N.&S.ends,	1,500	68.00	.059	7 60 000		
	PASCOE TOTAL,	44,330			38,000	·	
		WEST	REPUBL	IC.			
860'	#1, WEST REP. TOTAL.				950 950	64.00	.044
	WEST REP. TUTAL,				950		
	Ctt A TVD	AVALIAE	MMARY.	NOT AVAI	r.ART.F	TOTAL.	
	SHAFT.			NOT AVAL	DADLE .	168,500	
No. 9 SI	\$25,000 to 0.000 to 0	168,5		20.00	0		
Pascoe,		44,3	30	38,00		82,330	
West Re				95		950	
	TOTAL,	212,8	30	38,95		251,780	

ORE ON STULLS (Continued).

Ore on Stulls, December 31st, 1914, 251,780
Ore on Stulls, June 1st, 1914, 246,155
Increase on stulls, December 31, 1914 5,325

It will be noted that notwithstanding the fact that we have increased our production and reduced our costs, we have not done so at the expense of our broken ore reserve, for we show a larger reserve tonnage than that on hand when we assumed charge of operations.

We have also left off our record of Ore on Stulls, a total of 4,045 tons, which was reported by Republic Iron Company as "on stulls," as we found that small balances in Stope No. 4, 1050' Level, No. 9 Shaft, and Stope No. 2, 1950' Level, Pascoe Shaft, had been lost by the caving of the rooms before all the ore could be cleaned out.

We actually show an increase on stulls of 9,570 tons, for the seven months, if credit were taken for the amount charged off as lost.

We find 38,000 tons ore broken in Stopes that is not available, on account of same being tied up back of Pascoe Shaft. It seems that mining operations had been carried up too close to the Shaft, and the pillars started to cave and this broken ore had to be left to protect the shaft. In addition to this ore, it was necessary to fill the balance of the stope, on top of the ore, with rock filling. This ore cannot be recovered until Pascoe Shaft is abandoned, and even then, all the rock which has been dumped into stopes on top of the ore must be handled.

WEST REPUBLIC.

We have not undertaken any work at this property during the past year.

The old shaft house, ore pocket, and trestles had become badly decayed, and we have removed same.

The shaft is down to a depth of 860 feet where a lens of ore about

10 feet wide was being mined when operations were discontinued a number of years

ago. The records show 950 tons ore broken on stulls.

Our plans provide for driving the 1335' level drift, Pascoe Shaft, out into this territory, and we hope ore in paying quantities will be encountered.

REPUBLIC MINE

AVERAGE	MINE	ANALYSIS	OF	OUTPUT	FOR	YEAR-1914
	-	THE RESERVE THE PARTY OF THE PA	-	The Late of the Control of the Control	TAXABLE DISTRICT	STATE OF THE PARTY

GRADE	IRON PHOS.
Republic Bessemer,	66.80 .041
" Basic,	65.02 .070
" Pascoe,	57.51 .049
Averages all ores Run-of-Mine,	64,29 .053

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR-1914

		Mine		L	ake Er	ie	
GRADE	IRON	PHOS.	SILICA	IRON	PHOS.	MOIST.	
Bessemer Lump,	67.16	.045	2.33	66.70	.052	.17	One cargo only
Bessemer Crushed,	64.98	.035	4.07	64.70	.035	1.55	" " " (Cargoes made up (of Basic, Bess.
Basic Lump,	65.13	.060	4.94	64.70		•45	(and Pascoe Lump
Basic Crushed.	62.57	.067	7.21				(No Lake Erie (results taken.

ORE	STATEMENT	_	DECEMBER	37 ST	1914

	I	Run-of-Mi	of-Mine BESS.		BASIC	BESS.	BASIC	
	BESS.	BASIC	PASCOE	LUMP	LUMP	CRUSHED	CRUSHED	TOTAL
On Hand May 1st, 1914	22,024	12,914	43,615		5,3790			78,553
Output for Year,	33,853	24,708	14,305		3,970		338	77,174
Transfers between grades	18,180	31,726	5,885	372	29,861	7,719	17,839	
Total,	37,697	5,896	52,035	372	33,831	7,719	18,177	155,727
Shipments,				372	33,766	2,181	11,138	47,457
Balance on Hand at Mine,	37,697	5,896	52,035	0	65	0	0	95,693
In Stock at Presque Isle						5,538	7,039	12,577

REPUBLIC MINE

SHIPMENTS FOR YEAR-1914

GRADE	.POCKET	STOCKPILE	TOTAL
Republic Bessemer Lump,			372
Republic Basic Lump,			33,766
Republic Bessemer Crushed,			2,181
Republic Basic Crushed,			11,138
Total.	20,604	26,853	47.457

NOTE: --- As the ores from pocket and stockpile were dumped together at the Screening Plant we are unable to separate the different grades between pocket and stockpile shipments.

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REPUBLIC MINE.

COMPARATIVE MINING COST FOR YEAR.

	1914	1913	INCREASE	DECREASE
eneral Expense	.154			
Maint enance	.343			
Mining Expense	2.029			
Cost of Production	2.526			
EXPLORATORY	•009		100	
DEPRECIATION				
Equipment	.148			
Total Depreciation	•148			
laxes	.175			
Central Office	.128			
Sundry Expense	.059			
Supply Inventory	•001			
COST ON STOCKPILE	3.044			
Loading & Shipping	.043			
Total cost on cars	3.087			
No. days operating	193			
No. shifts and hours	1-8hr			
Avg. daily product	400			
COST OF PRODUCTION				
Labor	1.735			
Supplies	.791			
TOTAL	2.526			

REPUBLIC MINE.

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '14 77,174 Tons.	SUR	FACE.	UNDERGROUND.		TOTAL.	
PRODUCT '13	1914.	1913.	1914.	1913.	1914.	1913.
Avg. no. men working	77		187.		264	
Avg.wages per day	2.50		2.63		2.59	
Avg.wages per mo.25 days	62.50		65.75		64.75	
Avg. product per man per day	5.05		2.16		1.51	
Labor cost per ton	.495		1.22		1.715	
Avg.product breaking & trammg.			4.10			
Avg.wages for miners contract			2.77			
Potal avg.wages for contract			2.77			

Proportion of surface to underground men - 1914 - 1 to 2.34

	1 9 1 4 8 Months	1913	INCREASE	DECREASE
SURFACE				
Total no. of days	15,2941			
Average rate	2.50			
Amount	38,224.65			
Total no. of days	35,7784			
Average rate	2.63			
Amount	94,129.19			
Total no. of days	51,072½			
Average rate	2.59			
Amount	132,353.84			
Labor cost per ton	1.715			

No.shifts and hours - 1-8hr.

REPUBLIC MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES	AMOUNT 1 9 1 4	AMOUNT 1 9 1 3
*		10.	(8 Mos.)	
50% Powder	107,161	•108	11,616.29	
Total Powder	107,161	.108	11,616.29	
Fuse	158,445	3.774	598.00	
Caps	37,070	6.949	257.63	
Cap Crimpers	23	24	5.53	
Total Fuse, et	c.	861.16		
Total		12,477.45		
Product		77,174		
Pounds powder pe	r ton ore	1.39		
Cost per ton for	powder	.150		
Cost per ton for	fuce, caps, et	.011		
Cost per ton all	explosives	-161		
Avg. price per 1	b. for nowder	.109		

ANNUAL REPORT

(1914)

OF THE

IMPERIAL MINE.

Production and Shipments.

The Imperial Mine remained closed throughout the year 1914.

Surface.

No work was done at the mine during the year.

Estimate of Ore Reserves. Jan. 1, 1915.

Level	Shaft Pillar Tons	Available Ore Tons	Total Tons	Partly Developed Ore Tons	Total Tons
First	12,000	2,000	14,000		14,000
Second	23,000	28,000	51,000		51,000
Third	24,000	178,000	202,000		202,000
Fourth Total	45,000 104.000	200,000	245,000 512,000	80,000	325,000 592,000
	for loss in Mining		41,000 471,000	8,000 72,000	49,000 543,000

A factor of 13 cu. ft. per ton was used, and incidental rock was deducted on each level.

Luciu Eston

CROSBY MINE.

ANNUAL REPORT FOR 1914.

Operations at the Crosby Mine during the year 1914 were confined entirely to preparing for the extraction of the wash ore, which is to be concentrated. No shipments were made from the property, such ore as was hoisted being of low grade wash material and was stocked near No. 1 Shaft or dumped into the pit adjacent to No. 2 Shaft.

At the beginning of the year a force of approximately eighty men was employed, cleaning rock from the open pits, repairing the tramming and hoisting equipment, and developing the wash ore body on the second level. This force was decreased from time to time, and when operations were discontinued on October 31st, but twenty-two men were engaged. Four men were employed during the balance of the year, the superintendent, two watchmen, and the teamster. The mine pumps were pulled during the latter part of October.

The work accomplished during the year will be taken up under the various headings.

GENERAL SURFACE.

Considerable cleaning was done around the surface plant during the summer months, such as carting away the ashes from the vicinity of the boiler house, removing the rock sorted from the stocked ore, and burning the waste pieces of timber, bark and chips, which had collected in the timber yard or near the shaft. The ashes were spread over the property roads, and the rock was piled around the powder magazine, for the purpose of protection.

It was necessary to make minor repairs to the office, barn, and blacksmith-carpenter shops, and some of the decayed stringers and braces in the coaldock were replaced. The entire coal dock is in very bad shape, and a new structure has been recommended when mining activities are resumed. The mine buildings will also require extensive repairs.

The dry building and contents were totally destroyed by fire on the

morning of April 2nd, and one of the rooms in the laboratory was fitted up as a change house for the small underground force. Investigation failed to establish positively the origin of the fire, but there is no doubt about its having started from a candle left burning by one of the men working on the night shift. The last of the night shift force departed from the dry about 5:30 A.M., and the fire was discovered by the fireman on duty at 6:30 A.M. Several of the men admitted that they had used candles, but they were all equally positive that their candles had been extinguished before they left the building. The fire had gained such headway that it was beyond control, although the Mine and Village equipment was brought into service promptly. The wreckage resulting from the fire was removed and plans were made for a new structure, but this work was not undertaken. The concrete floor was not greatly damaged, and it is the present intention to construct a new dry on the old site, when underground operations are resumed. The insurance paid on the dry and contents was sufficient to cover the loss incurred.

The engine-boiler house and laboratory were destroyed by fire on the night of May 31st, and the machine shop was partly burned. The contents of the machine shop were not damaged to any great extent, and the boilers, being full of water at the time and the steam header having burst in the early stage of the fire, were not wrecked. The asbestos covering and the boiler fixtures were ruined. The contents of the laboratory, including the clothing of the underground force, was totally destroyed. The dynamo was absolutely ruined, and no attempt has been made to repair the electric engine and compressor, but unquestionably such repairs can be made. The hoist was overhauled and relined and that part of the cable not damaged was spliced onto the drum. Although the total loss, which was claimed on the contents of the engine room, was not allowed by the insurance company, the amount of settlement was quite satisfactory in lieu of the fact that most of the damaged machinery can be repaired.

The fire started in the engine room near the boiler room door, and although investigation failed to explain the origin definitely, it is now thought

probable that it was either a question of spontaneous combustion or that some one of the discharged Montenegrins, living in the camps to the north of the property, was instrumental in setting it. Subsequent to the dry fire, the Montenegrins were supplied with water from the boiler-room tap, and they were in the habit of passing through the engine-room door. The fireman on duty states that no one of them had applied for water on this particular night. All efforts to fix the blame on the Montenegrins failed, although the situation was investigated very thoroughly.

The fireman and pumpman had gone on duty at 6:30 P.M. and at 9:45 P.M. the pumpman came up from underground and went into the boiler room, passing through the engine room. He saw no signs of fire and states that he was not smoking at the time and did not strike a match, which is all corroborated by the fireman. The fireman had cleaned the fire under No. 1 boiler, and was sitting on a bench near the engine room door when he heard a crackling noise and opened this door to investigate. He discovered the fire along the east side of the room and in the rafters over head, and promptly blew the fire whistle. This was at 10:10 P.M. The Mine employees, living in the location, and the Village department were on the ground within twenty minutes and did everything possible, with the means at their disposal, to subdue the flames. The fire had gained such headway, however, that it was impossible to save the engineboiler and laboratory buildings, and so all efforts were directed towards the machine and carpenter shops, oil house, and coal dock.

within forty-eight hours, and the Mine pumps were started before the water had raised in the shaft. Even so, the pumps were submerged and started under water. Rough sheds were erected over the boilers and hoist, and the necessary repairs made by June 16th, when underground operations were resumed. The wreckage from the burned buildings was cleared away, the partly burned timbers being fed into the boiler fire box, and the scrap iron sorted into two piles. One of these piles IS COMPOSED of material which may be of use later, and the second comprises the

CROSBY MINE.

scrap. The north and west sides of the machine shop, which were partly burned, were repaired, the building furnished with a new roof and the driving belt and pulleys replaced. Plans have been made for a new engine and boiler house, but the work of erection will not be started until the washing plant plans are definitely settled.

When open pit rock work was discontinued on March 10th, the force employed here was engaged for several days in cleaning the surface drainage ditches of all material likely to form dams, excavating the old rock pile to make room for the new head frame and digging a ditch from the new pump raise to the south drainage ditch.

The boiler house sump was thoroughly cleaned during the year, and a plank frame built around the top of the concrete collar to prevent the washing of cinders and scale into it when cleaning boilers. Most of the material removed from the sump was composed of washings from the boiler room.

Of the 2,000 ton coal consignment received during the summer, over 1,800 tons were in dock at one time, and it was necessary to do considerable spreading in order to accommodate this quantity. The capacity of the dock has always been figured as 1,600 tons, but it is necessary to spread the coal when dumping in excess of 1,200 tons. There were 1,619 tons of coal on hand January 1, 1915, and this balance will remain stationary until pumping operations are resumed.

All the tools and scattered rail were removed from the pits and stored in the blacksmith shop.

STOCKING.

Stocking was begun on April 20th, and was carried forward until development work on the second level was discontinued, September 4th. A total of 8,324 tons of lean ore were dumped on the old stocking ground. This material averages 45% in Iron content and .050 in Phosphorus, and is available for steam shovel loading when wash operations are inaugurated.

During the months of January, February, and March 3,955 cubic yards of sand and 13,460 tons of taconite were removed from the old pit and dumped

CROSBY MINE.

STOCKING (CONTINUED).

on the rock pile to the north of the boiler house. In addition, 1,437 tons of rock were handled from the new pit during the fore part of January. The rock pile has been fanned out to the east by blocking one side of the tram car and resorting to side dumping. Owing to the proximity of the coal dock, it is impossible to fan but the northerly 300 feet, and this necessitated shifting the end sheave arrangement twice each week and the maintaining of an extra man on the dump. It is a long tram, and the cost per ton for handling rock keeps increasing steadily. It is the intention to utilize the old stocking ground for a rock dump when wash operations are started, there being room here for upwards of 100,000 tons.

ERECTING HEADFRAME.

The material for the new headframe was received early in the year, but as it was deemed advisable to continue underground operations at No. 1 Shaft until fall, the work of dismantling the old structure was delayed. The Mine carpenter and helper spent the last two weeks of July and the entire month of August framing the headframe and underground pocket and shaft sets. The work of dismantling the headframe was started on September 4th, and an average force of six men was engaged on this job during the following week. These men were employed on erection work during the balance of September, and during the entire month of October, when all activities at the Mine were suspended. The structure was completed, with the exception of the dump pocket and skip guides. The skip dumps, including the plates, are in place, as are the sheaves, and one week should be sufficient time for a force of six men to put the headframe in shape for hoisting. All the new plank to be used in the headframe pockets and the excess shaft timbers have been piled near the office. The estimated cost of the new headframe was \$4,500.00, and the actual cost to date, including the rock excavated for the dump, is \$3,735.08. The unexpended balance will be more than ample to cover the charges for completing the work.

SUPPLIES.

Besides over \$800.00 worth of pine and fir plank and square timber, which is piled near the office, there is 6,384 feet of 8-foot mine timber, 132 cords of 6-foot lagging, and 57 cords of 10-foot lagging stored in the timber yard. Piled on the old stocking ground there are 21 - 35 foot trestle stringers and 54 pieces of 20-foot switch caps, which have never been used.

On January 1st the barn supplies included $8\frac{1}{2}$ tons of hay, one ton of straw, and 379 bushels of oats.

OPEN PIT WORK.

The work of removing the pile of taconite and sand from the open pits, which was started November 13th, 1913, was continued until March 10th, A force of from 16 to 20 men was employed in the pits, the bulk of the work being done at the north and west ends of the old pit, where milling activities had been conducted prior to 1910.

In extracting the merhantable ore from this old pit, quantities of taconite and sand had been dumped over the milling chutes in the deeper parts of the pit, and a considerable amount of surface wash had been added by the action of the flood waters on the pit banks. As the work of removing this material was undertaken during the severe winter months, it was necessary to do a large amount of blasting, especially where the sand was mixed with the rock, and this added materially to the cost. The north and west sides of the pit were cleaned down to the solid wash ore, as it will be from this part of the pit that a large amount of the material, to be sent to the proposed concentrating plant during at least the first season, will come. The balance of the wash product will be gained from the new pit during the early operations. Considerable cleaning was also done along the east bank of the pit, and the bank was cribbed where necessary to prevent sand washes from being carried into the cleaned areas. Although considerable sand and taconite remains at the south end of the pit, it will not be necessary to remove any great quantity of it for

several years. Enough wash ore is available to supply a plant of the size contemplated for more than one season at least.

The estimated cost for handling the taconite from the old pit was 30 cents per ton, and the sand 45 cents per yard. This compares with an actual cost of 43.7 cents in the case of the rock and 42 cents for the sand. A total of 14,875 tons of rock were removed, 13,460 tons during 1914, and 3,955 yards of sand. The increased cost for the rock was due to the fact that it was necessary to blast the frozen mass and that much of the material, which was covered at the time of making the estimate, was of such size that it had to be sledged and block holed.

The 1,437 tons of taconite, cleaned from the new pit, was in scattered piles, but it was not mixed with sand and no blasting was necessary. This material came from the north end of the pit, where there is a comparatively large body of clean wash ore uncovered. The estimated cost here was 50 cents per ton compared with an actual cost of 48 cents.

The east end of the new pit extends right up to the Great Northern tracks, and as these tracks were settling continuously and have to be jacked up and filling material placed under the ties, due to the caving of the pit bank, it was deemed advisable to crib this bank and block behind the cribbing with taconite. The rock ballast from the old headframe was used for this purpose.

UNDERGROUND.

PUMPING.

At the beginning of the year the Nos. 4 and 9 Cameron Pumps were installed at the No. 2 Shaft pump house and the Nos. 6 and 7 Camerons at No. 1 Shaft. The No. 10 Knowles was never dependable, and as it always refused to work in emergencies, unless the pumpman gave it constant attention, it was decided to dismantle and transfer the pump to surface. The No. 9 Cameron at the

new shaft was equipped to pump to the surface drainage ditch and was called upon to handle only the flood waters from the pit, while the No. 4 raised the second level water to the first level, where it drained to the emergency pumps. When a holing was effected between the second level drifts from the two shafts, on August 7th, the No. 9 was moved to the No. 1 Shaft pump house and the No. 4 installed as a boiler feed pump. The water from the No. 2 Shaft workings then drained on the second level to No. 1 Shaft and was handled by that equipment. Aside from the surface rain water, which drained to the emergency pumps on the first level, the average amount pumped during the last few months that the Mine operated, was 167 gallons per minute. This water comes entirely from the second level workings, and may be considered as a steady flow. It was decided to discontinue pumping for the winter and the Nos. 6, 7, and 9 Camerons were disconnected on October 28th and moved up to a platform placed in the shaft three sets above the first bevel plat. The water would have to raise and flood the entire first level before reaching these pumps, and this condition is not likely until the spring thaw, unless there should be unusual winter rains. The emergency pumps have been carefully overhauled and oiled, so that they are in shape to be started on short notice, even should they be under water. By December 1st the water had raised in the shaft to within 10 feet 4 inches of the first level and on January 1st it still stood at this elevation, showing that the first level will not be flooded by the underground flow.

A new 5 x 9 foot, two-compartment raise was pushed through to surface from the emergency pump-house during the first two months of the year. The idea of this raise was to accommodate the discharge limes and furnish a traveling road for the underground force. Heretofore there have been numerous accidents caused by particles falling back into the shaft from the skip dump and striking men in the ladderway. The two emergency pumps were not filled, when installed, with their proper sized suctions and discharges, and this defect was remedied. The pumps were previously bushed down and together discharged through an eight

inch line and were furnished with a ten inch suction. Now each pump has an eight inch discharge and ten inch suction. At no time during the past summer was it necessary to operate both pumps for more than 30 minutes at a stretch, even during the heavy rain storms. During the summer of 1913 the Mine was flooded upon several occasions, due to inadequate pumping facilities. Originally an estimate of \$600.00 was made to cover the cost of a single compartment raise from the emergency pump house and for installing a No. 10 Cameron pump from the Ishpeming District in exchange for the No. 10 Knowles. It was decided later to enlarge to two compartments and close timber this raise and the additional cost of doing this work, together with the expense of making the changes in the pumping equipment, brought the total charges against this item to \$1,233.58. The cost of the main level dams, which were constructed to divert the flood water to the emergency pumps, was also included under this heading.

TRAMMING EQUIPMENT.

The electric motors were overhauled during the fore part of the year. Besides being fitted with new brasses, a number of worn parts were replaced. The bad condition of the tracks, due to sand washes during the summer of 1913, was largely responsible for the condition of the motors. The 24 motor cars were gone over carefully and put in good shape. A number of wheels, axles and brasses were replaced and the frames of the cars, which had been badly battered by the heavy chunks of taconite fed from the milling chutes, were taken apart and straightened. The cars and motors were switched into the highest part of the first level and the motors were stripped of all parts which were likely to be injured by water. All the bearings were greased. The cost of repairs was much higher than the amount estimated, due largely to the hard usage to which they were subjected in hauling the rock from the pits.

REPAIRING FIRST LEVEL DRIFTS.

The work of re-timbering the main level northwest drift, which was started during November, 1913, was completed by the end of January, and the six

men employed on this job spent the month of February replacing all the decayed switch sets on this level. The northwest drift extends under that portion of the old pit, which has been cleared of rock, and a large part of the wash ore, to be mined during the first season's operations, will be trammed to No. 1 Shaft through this heading. More or less sand washed through the milling chutes during the past summer, especially at the west end of the Mine, but no attempt was made to remove it. It was necessary to replace a few caps and some of the lagging in the westerly workings of the main level. This level was inspected at the end of the year and found to be in good condition. It is probable that very little material will slab from the sides and back of the drifts, as all openings to the open pit were carefully lagged or bulkheaded in order to keep out the frost. The estimated cost for re-timbering the main level drifts was \$1,500.00 and this amount was exceeded by \$38.57, due to the repairs made necessary by caves subsequent to the date of making the estimate.

RE-TIMBERING SHAFT AND MAIN LEVEL PLAT.

The timber at the firsthavel plat was taking weight and had settled to such an extent that the headroom was not adequate. The dump pockets and shaft timbering were also in a bad state, and when hoisting operations were discontinued on September 4th, the work of remedying these conditions was started, the greater part of the second level force being retained. It was necessary to remove all the loose material, which had slabbed or cracked from the back of the level plat, and the openings thus made were blocked solid with cribbing. Adjacent to the shaft the loose back was removed for 25 feet above the caps. All the plat sets were replaced with sound timber, the back raised to eight feet above the motor track rails and the room widened two feet, so as to afford the men more room for dumping motor cars. This job took considerable time, as the men were obliged to work very carefully in removing the loose chunks of rock and ore, some of which weighed several tons. The dumping pocket was torn out and all the decayed timber and plank replaced. The material removed

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in making these repairs was stored in the drifts between the shaft and the dams, hoisting having been suspended in order to commence work on the head-frame. The estimated cost to cover this work was \$1,500.00, and the actual cost \$976.68.

The job of re-timbering the shaft was started soon after the plat work and was completed the last week of October. The casing plank was replaced from a point one set below the lip of the dumping pocket to the collar of the shaft, and most of the dividers and sheeting were removed. The shaft sets were found to be sound, from a point 25 feet above the first level floor to within 16 feet of the collar, but the balance were badly decayed and were replaced with new fir timber. New bearing timbers were placed at the first level, between this level and the collar and at the collar. The shaft is now in very good shape, and it will not be necessary to make any further repairs for some time to come. The cost of doing this work amounted to \$1,199.52 compared with the estimate of \$1,250.00.

OPERATIONS AT NO. 2 SHAFT.

At the beginning of the year two contracts were engaged in developing the second level from No. 2 Shaft, such work having been started during the latter part of 1913. This force operated here until the middle of April, when they were moved to No. 1 Shaft. The drift to the north of the shaft was completed, and owing to a question of grades, it was deemed advisable to discontinue the easterly drift and complete the work from the No. 1 Shaft side. As it was, the heart of this drift had to be cut down five feet in order to afford a favorable grade for tramming towards No. 1 Shaft.

The north motor drift was pushed through solid taconite for 330 feet, the wash ore, which was just over the back at the shaft end, being 12 feet over the back at the breast. The northerly extension of the wash ore had previously been determined by winzes from the first level. It is the intention to mill the wash ore above the workings during the first season's operations, in order to furnish a place for dumping the waste rock encountered in open pit mining to the north. The wash ore developed in the immediate

vicinity of No. 2 Shaft is the deepest sizable deposit ever encountered at the west end of the Mine. Besides making the northerly extension, this gang put up a 40-foot ventilating raise and made a connection, motor drift size, between their workings and those of the east drift, 76 feet distant. This gang is credited with 403 feet of 8 x 8 foot motor drifts. The material encountered was solid taconite, and the cost of \$10.14 per foot was not so unsatisfactory when the hand drilling is considered. The estimated figure was \$10.00 per foot.

The east drift was pushed towards No. 1 Shaft for 338 feet, and a ventilating raise was holed to the open pit 74 feet above. The raise encountered 10 feet of wash ore immediately above the drift, the remaining 64 feet passing through a broken taconite. The drift itself cut a lean wash ore, with seams and horses of taconite at irregular intervals. A grade of 0.5% was maintained, the heading, which started from the No. 2 Shaft as full motor drift size, was gradually reduced until at the breast it was but 4 x 5 feet. This drift has now been stripped back for 178 feet from the breast, a holing having been effected from the No. 1 Shaft side. The wash ore body developed by this drift is limited in extent, is mixed with taconite seams, and owing to the heavy rock capping, it will be necessary to mine it underground. The average cost per foot was \$7.38, compared with an estimated figure of \$7.00, the higher cost being explained by the added expense of the ventilating raise, which was made necessary by the bad air conditions.

OPERATIONS AT NO. 1 SHAFT.

The gang, which has been engaged on the pump house raise, started sinking No. 1 Shaft on March 13th. All loose material was cleaned from the shaft timbers and the mud from the skip pit. A half ten bucket and cross head were installed and a landing platform built just above the shaft collar. The shaft was not sunk full size, 7 x 10 feet outside being ample room for the ladder, pipe and skip ways. The shaft will be stripped full size when it is desirable to handle the wash ore product on the second level. The shaft was bottomed, 50 feet below the first level, on March 31st; the distance sunk being 35 feet and the cost per foot \$28.15. The force was then engaged in

cutting the pump house, 8 x 12 x 16 feet and two sets in depth, and the second level plat. The total cost of sinking the shaft and completing the pump house and sump was \$985.46, compared with an estimated figure of \$1,000.00.

The analysis of the material cut in the shaft and pump house follows:

NO.	1	SHAFT.	FE.	PHOS.	MN.	PUMP HOUSE	BREAST.	FE.	PHOS.	MN.
14331	-	1423'	47.80	.051	.90	1413 -	1406	47.79	.039	.86
1423'	-	1417'	48.90	.063	.90	1406 -	1398	52.15	•055	1.04
1417	-	1411'	49.88	.034	.75					
1411*	-	1405"	52.55	•051	.43					
1405	-	1398'	52.35	.063	.90					

By April 20th the second level plat had been cut, a switch placed so that tramming could be done from both the north and south drifts and the bucket used while sinking was replaced by a skip. The two gangs from No. 2 Shaft were added to this working force and operations were conducted on three 8 hour shifts until June 16th. The south drift had been extended 170 feet from No. 1 Shaft, at which point a crosscut was to be driven out under the old stocking ground to the east and a second opening headed westward towards the No. 2 Shaft workings. As there were now three headings to work in, the force was put back on two 8 hour shifts. The east crosscut was discontinued after progressing for 110 feet, as it had encountered solid taconite and it was considered inadvisable to continue the work of preparing for the extraction of the merchantable ore in the track and shaft pillars. It is the intention later to extend this crosscut for 300 feet and raise to surface from the breast. This raise may then be stripped down and a shaft equipped to handle the merchantable ore remaining in the Mine. The gang engaged here was moved into the north drift and turned off a crosscut to the east, 35 feet from the shaft. After progressing for 110 feet this heading was turned

due north and was carried parallel to the main drift, thus blocking out a 100 foot pillar. The main north drift was extended 358 feet from the shaft and the south drift 380 feet, besides stripping back the No. 2 Shaft workings for 178 feet from the point where the holing was effected. All workings to the north of the shaft were carried full motor drift size, while those to the south, with the exception of the last 100 feet drifted and the stripping, were carried 6 x 6 feet in section. All of the workings will be stripped to motor drift size when wash ore operations are carried down to this elevation.

In order to keep the northerly workings in ore as fare as possible, the dip of the formation being about 5 degrees to the south, a grade of 1.8 per cent was maintained. The southerly workings have a grade of 0.5 of a per cent.

Two 3 x 6 foot crosscuts, 100 feet apart, were driven westward from the north drift and progressed 142 and 150 feet, respectively. These crosscuts encountered and followed up the bottom taconite, both breasts being in a good grade wash material when work was discontinued. With the exception of the last fifty feet of the crosscut driven east from the south drift, which cut broken taconite, and occasional seams and horses of taconite, the second level workings in the neighborhood of No. 1 Shaft have passed through a clean wash ore and have been the means of adding about 10 percent to the estimated tonnage of this material. The body of wash ore so far developed here is over 600 feet in length and has an average width of 250 feet. Additional development work will undoubtedly result in increasing materially the limits of the deposit, especially to the east and west, the area to the north and south having been pretty thoroughly explored by diamond drilling and test pitting. This work may be undertaken at any time without interfering with wash ore operations, which will be confined for some time to the open pit material above the first level.

Progress on the second level from No. 1 Shaft has amounted to 807 feet of motor drifts, 437 feet of 6 x 6 foot openings, 178 feet of stripping and 292 feet of 3 x 6 foot crosscuts. The estimated and actual costs per foot for the different work was as follows: motor drifts -, estimated cost \$10,00, actual cost

\$9.41; 6 x 6 foot drifts - estimated cost \$7.00, actual cost \$6.85; stripping estimated at \$5.00 and cost \$4.84 and the crosscuts estimated at \$3.00 and cost \$2.57.

The average grade of the ore removed from these workings has been 45 percent in Iron content and .050 in Phosphorus. Very few Manganese determinations were made, but it is safe to assume that the average will be under 1 per cent.

ORE ESTIMATE OF JANUARY 1ST, 1915.

Following is an estimate of the merchantable ore in sight at the Crosby Mine as of January 1st, 1915. An average of 56 percent Iron and .040 Phosphorus was used as the basis for the estimate.

	JANUARY 1st, 1915.	JANUARY 1st, 1914.
East Forty	86,000 tons	86,000 tons.
West Forty	122,000 "	122,000 "
TOTAL	208,000 "	208,000 "

Practically all of this ore is located between the first level or is included in the shaft and track pillars and, therefore, is not available at the present time.

The following is an estimate of the wash ore in sight as of January 1, 1915. This estimate is based on an average Iron content of 50 per cent and .045 Phosphorus. A comparison with the estimate of January 1st, 1914, shows that the development work undertaken during 1914 has been the means of increasing the wash ore reserves by 292,000 tons.

	JANUARY 1ST, 1915.	JANUARY 1,1914.	INCREASE.
Open Pit	1,431,000 tons.	1,330,000 tons.	101,000 tons.
Underground	1,091,000 "	900,000 "	191,000 "
TOTAL	2,522,000 "	2,230,000 "	292,000 "

Figuring on a 60 per cent concentration, treatment of the 2,522,000 tons of wash ore would yield 1,513,200 toms of concentrates compared with 1,338,000 tons in the case of the former estimate. The increase in the estimate

of underground ore has been almost twice that of the material to be gained by open pit methods, and the further development of the second level will be in ore bodies outside the limits of the stripped area.

CROSBY MINE WASHING PLANT.

During the fore part of February, the Agent for the Mississippi
Land Company suggested that a desirable site for a washing plant might be
found on their land to the north of the Mine, and it was considered advisable
to survey and prepare a contour map of this district. The Mine engineer and
a small force of choppers were engaged on the field work during the greater
part of March and April. Later the force was employed in running out proposed
railway spurs, locating sites for the storage basin, dam, and plant. It was
decided that a desirable site was afforded by these lands, and that the storage
basin was feasible both from the standpoint of a tailing dump and water resevoir.

A washing plant, located as proposed, would entail an expenditure practically one half again as much as the Oxhide Lake project. Included in the location north of the Mine would be the cost of a mile of track and the rolling stock necessary for handling the ore to and from the plant. The Great Northern switching charge would be ten cents per ton for the Oxhide proposition, compared with an estimated handling expense of five cents per ton for the proposed north location. The haul to Oxhide Lake by the Great Northern Company would necessitate running on their main line for over two miles, and without doubt more or less serious delays would occur in obtaining right of way for Crosby wash ores during the heavy shipping seasons.

The ground along the proposed spur has been sounded, as has the dam sight and storage basin.

A weir was placed across the outlet from the swamp, which is to be utilized as a storage basin, and daily readings have been taken extending from May 1st to October 31st. The average flow during May was 2,814 gallons per minute, June 488, July 298, August 32 September 370, and October 122 gallons

per minute. Allowing for a loss by evaporation and seepage of 200 gallons per minute, this water supply, contained in a storage basin, would have been adequate for all possible requirements at a plant of the size proposed. Plant requirements are estimated at 600 gallons per minute. The mine pumps handle 167 gallons per minute, which is the average flow from the underground workings, and with the proposed pumping arrangements, this supply could be utilized when needed.

CROSBY MINE.

COMPARATIVE AVERAGE WAGES AND PRODUCT.

PRODUCT '14 O Tons	St	IRFACE	UU UU	DERGROUND	TO	TAL
PRODUCT '13 201,771 "	1914	1913	1914	1913	1914	1913
Avg. number men working	14	27	19	119	33	146
Avg. wages per day	2.87	2.67	2.86	2.60	2.87	2.61
Avg. wages per mo. 25 days	71.75	66.75	71.50	65.00	71.75	65.25
Avg. product per man per day	-	22.74	-	5.13		4.19
Labor cost per ton	-	.117		•507	-	.624
Diff. in labor cost per ton	_	+001	_	++202	-	4.203
Avg. product breakg.& trmg.			- 1	8.46		
Avg. wages for miners contract			-	2.73		
Avg. wages for trammers contra	et et			2.64		
Total avg.wages for contract			_	2.73		

Mine closed November 13, 1913.

SURFACE	1914	1913	INCREASE	DECREASE
Total number of days Average rate	4308 2.87	8871 2•67	• 20	4563
Amount	12,374.47	23,666.50		11,292.03
UNDERGROUND Total number of days Average rate	5,995 1 2.86	39,300-3/4	•26	33,305½
Amount	17,147.39	102,349.67		85,202.28
Total days Average rate	10,303\frac{1}{4} 2.87	48,171-3/4 2.61	• 26	37,868 g
Total amount	29,521.86	126,016.17		96,494.31
Labor cost per ton	_	.624		

No. shifts and hours

2-8hr

INCREASE WAGES PER DAY:

SURFACE .20 --- 7.49% UNDERGROUND .26 --- 10. % Total .26 --- 10. %

REPUBLIC MINE:

The Republic Mine was purchased on May 1st, but we did not take over the operation until June 1st, at which time Mr. J. M. Bush was placed in charge. His report for the balance of the year is a very interesting document, and the results obtained reflect credit on his ability.

We have not yet reached the limit of cost, as many of the improvements recommended when the property was purchased are yet to be made. In comparing costs with those obtained by the old company for 1912 and 1913 it is well to bear in mind that we have entirely overhauled and rebuilt the pneumatic power plant, and are sinking No. 9 Shaft and the Pascoe Shaft, all of which has been charged to operations. If we are to secure an output of 150,000 to 175,000 tons per year, it will be necessary to sink continuously in order to keep the development work ahead of mining. Practically no sinking had been done for two years before we took over the property, and consequently the development is far behind what it should be.

IMPERIAL MINE:

The Imperial Mine Lease has four years to run from April 1st. Even if the mine is operated continuously we cannot exhaust the estimated reserves in that time. We have spent a large sum of money in erecting a crusher, and it would seem advisable to either apply for an extension of the lease or to purchase the property, if it can be bought for a small sum. This Company and Messrs. Pickands, Mather & Company own the Webster Mine, lying immediately west, which will undoubtedly furnish all the tonnage of this grade that can be sold for some years to come, so that we could not afford to make any large investment in the fee of the Imperial. This question should be considered and some conclusion reached as soon as possible, so that the matter may be taken up with the Michigan Land & Iron Company during this dull period in the iron market.

JUNCTION FORTY:

By arrangement with the Lake Superior Iron Company the deposit of ore on our Junction Forty, adjoining the Section Sixteen Mine, is being explored, and is turning out exceedingly well. The ore is of Abbotsford grade, but unusually high in Iron and low in Phosphorus, the average analysis showing - Iron 65.22 and Phosphorus .0103. In addition to the hard ore, there is an underlying deposit of soft ore, which has not yet been explored, but from analyses of ore adjacent on the Lake Superior land is of good non-Bessemer grade. At the end of the year the ore is still continuing to the West, and there is no reason why it may not extend entirely across the Forty. In this event, there will be a very considerable tonnage, probably sufficiently large to justify a separate development.

WAGES:

There was a general reduction of ten percent in wages, effective

October 1st, which has been reflected in the cost of the ore since that time.

The reports submitted for each mine show what this has been in percentage, and also in dollars and cents.

EDUCATIONAL WORK:

The educational work under Mr. Stephenson has been remarkably successful, and his report for the year is an interesting one. I have permitted him to include a photograph of the class so as to show the age and appearance of the men.

The educational work in the mechanical and electrical departments has continued very successfully under the direction of Mr. Gallagher, Assistant Mechanical Engineer, and Mr. Stanford, Chief Electrician.

LEASES:

The only outstanding lease on lands of this Company is held by the Empire Iron Company, covering the $E_2^{\frac{1}{2}}$ of the SW $\frac{1}{4}$ of Section 19, 47-26.

TAXES:

Following their usual practice, the Tax Commission re-valued all the iron mines during the past year. At the hearing in Lansing, at which you were present, they insisted on eliminating from the cost the items of unsuccessful explorations and depreciation of investment. This, of course, increased the profit at all of our mines, and had it not been that the Commission increased the life of the mines and made other allowances, the values would have been very largely increased, instead of slightly decreased as they were.

THE CLEVELAND-CLIFFS IRON CO.

MINING DEPARTMENT.

VALUATIONS - MINE REALTY.

MINE.	AS ASSESSED 1 9 1 2	AS ASSESSED 1 9 1 3	AS ASSESSED 1 9 1 4	
Negaunee	5,355,000	4,555,000	4,240,736	
Maas	4,505,000	2,987,000	2,530,650	
Lake	2,925,000	2,677,500	2,480,220	
Princeton No. 1	63,000	24,400	10,530	
Princeton No. 2	472,500	565,000	246,312	
Austin	382,500	280,000	203,520	
Stephenson	321,300	228,000	100,000	
Lloyd	222,000	90,000	56,000	
Morris	180,000	154,500	54,624	
Chase	90,000	40,000	15,000	
Barnes & Hecker Exp.	2,520	51,000	51,000	
C. & N.W. Explor. 19-45-25	8,500	10,000	10,000	
C. & N.W. Explor. 21-45-25	85,000	20,000	20,000	
C. & N.W. Explor. 29-45-25	42,500	20,000	20,000	
Francis	42,500	42,500	42,500	
Johling	85,000	100,000	84,000	
Gwinn	204,000	195,500	199,903	
Gardner	76,500	70,000	70,000	
Mackinaw	119,000	70,000	70,000	
Athens	565,000	750,000	611,500	
Salisbury	149,850	117,000	50,000	
Cliffs Shaft	2,316,600	1,961,000	2,410,040	
Jackson	225,000	250,000	250,000	
Exploration - 6-47-27		311,000	315,000	
Imperial	20,000	95,000	159,160	
Republic			958,945	
TOTAL,	\$18,458,270	\$14,617,700	\$15,259,640	

STATEMENT OF RATE OF TAXATION PER \$100.00

		1914.	1913.	1912.
City of	Ishpeming	1.66	1.69	1.76
	Negaunee	1.43	1.36	1.32
	Ironwood			1.07
	Marquette	1.72	2.13	1.78
Tilden '		1.18	1.25	1.21
Spurr		1.76	1.59	2.49
Forsyth		1.94	1.68	1.81
Montrea	1"			1.26
Knight	,	2.22	2.10	1.90
Richmon	d"	1.98	2.07	2.07
Ely		1.35	1.47	1.80
Ishpemi	ng	1.98	2.04	3.33
	County, Minn.	4.61	4.72	3.77
	Twp.	1.32	1.35	1.25
Mastodo	n"	1.53	1.18	1.07
Negaune	e"	3.25	3.38	5.53
Sands		1.48	1.48	3.50
Marquet	te	1.23	1.30	1.93
Iron Ri		1.74		
Au Trai			4.41	4.45

ANALYSIS OF RATE PER \$100.00

	Ishpeming.	Negaunee.
State Tax	.19	.19
County "	.27	.27
School "	•54	.36
Highway"	.24	.15
City "	.17	.31
Fire "	.05	
Library"	•05	
Sewer "	-01	
County Road Tax	•08	•09
Cemetery	.01	
Water Tax	•05	
Special Tax		.03
Total	1.66	1.43

REPORT OF THE ENGINEERING FORCE EMPLOYED DURING THE YEAR 1914,

AND A BRIEF OUTLINE OF THEIR WORK.

BY C. J. STAKEL, ASSISTANT ENGINEER.

THE FORCE.

At the end of the year, the following engineers were employed in the Ishpeming office: C. J. Stakel, J. F. Hanst, H. O. Moulton, R. J. Chenneour, J. K. Osborne, J. E. Hayden, E. L. Derby and M. F. LaCroix. F. G. Rockwell was a regular member of the force from May 7th to November lst. During November and December he spent most of his time with the Geological department. Albert Rock was employed as a helper during the entire year. Edward Ham, John Trosvig and Arthur Ass acted as assistants to the engineers. Edward Ham was employed until September lst and the other two men until October 15th, at which time the force was curtailed. In addition to these men, from two to four axemen were steadily employed from May 5th to November 16th.

The following is a table showing the number of days each man worked, the days lost through illness, vacations, etc, and the percentake of time put in by each man:

NAME.	EIGHT HOUR DAYS WORKED.	DAYS VACATION.		TOTAL DAYS	PERCENTAGE OF DAYS WORKED.
C.J.Stakel	261	141		275=	94.7
J. F. Hanst	268	2	5½	275	97.3
H.O.Moulton	258	14분	3	275	93.6
R.J. Chenneour	2572	16	2	2752	93.5
J.K.Osborne	247	251	3	2752	89.7
J.E. Hayden	236 ¹ / ₂	17=	212	2752	85.8
E.L.Derby	250	251		2752	90.8
M.F.LaCroix	201		note below		93.5
F.G.Rockwell	1622	THE RESERVE OF THE PROPERTY OF	18 18	1632	99.4
John Trosvig	2072	6	51/2	219	94.8
Albert Rock	265	2	8=	275	96.2
Arthur Aas	199	91	51/2 81/2 101/2	219	90.9
Edward Ham	166	9½ 18½		1842	89.9
Daward Hom	700	105		1042	09.9

NOTE: Mr. LaCroix was given a leave of absence for about three months.

NOTE: Mr. Rockwell was absent on a six weeks vacation just previous to joining the Engineering department.

In compiling the above table, credit was given each man for Sunday work done at the mines, such as shaft plumbing, special main level surveys, etc.

The following table shows the percentage of time worked by each man for the years 1913 and 1914 arranged in proper sequence:

NAME •	1913. DAYS WORKED.	PERCENTAGE OF TIME WORKED.	<u>.</u>	NAME.	1914. DAYS WORKED	PERCENTAGE OF TIME WORKED.
E.L.Derby	273	98.9%		J.F. Hanst	268	97.3%
J.K.Osborne	271	98.2		Albert Rock	265	96.2
W.L.Scanlan	203	98.2		John Trosvig	207=	94.8
Arthur Aas	270	97.8		C.J.Stakel	261	94.7
C.J.Stakel	267	96.7		H.O.Moulton	258	93.6
H.O.Moulton	2642	95.6		R.J. Chenneour	257	93.5
John Brosvig	263	95.3		M.F. LaCroix	201	93.5
Albert Rock	262	95.0		Arthur Aas	199	90.9
J.E. Hayden	261	94.7		E.L.Derby	250	90.8
R.J. Chenneour	261	94.7		Edward Ham	166	89.9
J.F. Hanst	252	91.3		J.K.Osborne	247	89.7
M.F. LaCroix	241	87.3		J.E. Hayden	2362	85.8
M. F. LaCroix	lost some	e time		J.E. Hayden has	s a low	percen-
because of i	llness.			tage on accoun		

The following table shows the number of working days lost by each man on account of illness or vacations during the years 1911, 1912, 1913 and 1914:

	191		1912.		1913		1914	THE RESERVE OF SHIP PROPERTY.
NAME.	VACATION.		VACATION.		D A Y VACATION		DAY VACATION	
C.J.Stakel	12		19		9		14글	
R.D.Skelley	252	1						
J.F. Hanst	121				24		2	5 2
C.T.Kriebel	17	4		106				
E.C. Weinsheimer	131	41	19	1				
R.J. Chenneour	13½ 12½	4 4 1 2 7 4	13		15		16	2
H.O.Moulton	1		81/2		112		141	3
E.G.Sterling	1	2	3 1 2½ 10½	녆			~	
J.K.Osborne	121	4	1	1글 2글	21	21/2	251	3
Fred Flink	5		21/2					
J.E. Hayden	1 1 2		102		142	1/2	175	21분
M. F. LaCroix	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		192		141/2 201/2 1/2 8/2	140100 140100 440	14	
E.L.Derby		542		32	12	1 2	25½	
John Trosvig	1 2		$6\frac{1}{4}$		81	41		5 1 2
Albert Rock	1 <u>ភ</u> ្ជិ 5 3	1	3	11/2	10	4	6 2	81
Arthur Aas	3		9	2	4	4 2	9글	5\frac{1}{2} \\ 8\frac{1}{2} \\ 10\frac{1}{2}
W.L.Scanlan		1	2		4 3 ¹ / ₂			

The following table shows the total number of working days lost through sickness or vacations for the last four years by the men now employed in the office:

NAME.	DAYS VACATION.	DAYS SICK.	TOTAL DAYS.	AVERAGE DAYS PER YEAR.
C.J.Stakel	54 ¹ / ₂	0	54 ¹ / ₂	13.6
J.F. Hanst	382	51/2	44	11.0
H.O.Moulton	352	3	382	9.6
R.J. Chenneour	56 ¹ / ₂	93	664	16.5
J.K.Osborne	41 2	12	53 ¹ / ₂	13.4
J.E. Hayden	44	22	66	19.9
E.L.Derby	27	88	115	32.9
M.F.LaCroix	56½	142	71	21.8
Albert Rock	20	15	35	8.7

NOTE: All of the above men have been employed four full years or more except Mr. Hayden, who has only been employed three years four months, Mr. Derby, three years six months, and Mr. LaCroix, three years three months.

The following table shows the number of working days in the for past year and the distribution of the department's time xx the various properties:

MINES, WATER POWERS, EXPLORATIONS, ETC.	TOTAL DAYS.	% OF TOTAL DAYS.
Athens mine	137	4.58%
Bunker Hill mine	30	1.00
Chase mine	60	2.00
Crosby mine	61/4	0.21
Cliffs Shaft mine	301 2	10.10
Dexter mine	574	1.91
Gwinn District mines	30 ¹ / ₂	1.02
Imperial mine	38	0.13
Jackson mine	11 <u>1</u>	0.39
Lucy mine	16	0.54
Lake mine	140	4.76
Lloyd mine	128	4.30
Maas mine	2282	7.67
Morris mine	763	2.57
Negaunee mine	214	7.18
Republic mine	253	8.48
Salisbury mine	1194	4.00
Crystal Falls explorations	$11\frac{3}{4}$	0.40
Iron River explorations	4	0.13
North Lake explorations	384	1.28
AuTrain water power	8	0.27
Carp river water power	39	1.32
Michigamme river water power	421	1.42
Steam electric installation	121	0.41
Carbon reports	452	1.52
Canadian pyrite lands	$3\frac{1}{2}$	0.12
Michigan Mineral Land Company	$5\frac{1}{4}$	0.18
	A SALES CONTRACTOR OF THE PROPERTY OF THE PARTY OF THE PA	

MINES, WATER POWERS, EXPLORATIONS, ETC. TOTAL DAYS. % OF TOTAL

		DAID.
Republic Iron Company's lands	772	2.59
Section 2, 47-27	77½ 3½	0.12
Section 3, 47-27	50	1.68
Section 4, 47-27	36	1.21
Section 5, 47-27	1122	3.78
Section 9, 47-27	24½ 94¾	0.82
Section 11, 47-27	943	3.18
Section 15, 47-27	4	0.13
Iron Cliffs drive and vicinity	554	18.60

It will be noted that over 18% of the department's time was charged against the Iron Cliffs drive territory. This covers the time spent on the coordinate lines established during the summer on the favorable iron formation on Sections 12, 13, 14, 15, 22, 23, 24, 25, 26 and 27, T. 47 N., R. 27 W. and Sections 17, 18 and 19, T. 47 N., R. 26 W. Sections 12 and 13 were contoured during the months of May, October and Movember. The Cliffs Shaft mine required considerable attention, most of the time being spent on the estimate maps, which were finished. The pump house construction work on the 15th level and the check surveys during the spring months also account for some of the time. The Maas, Negaunee and Republic mines are the next three largest items. At Republic, a complete survey was made of the surface of Section 7 and a portion of Section 18 and all of the underground working levels checked over. At the Maas mine, the pump house and sump, and at Negaunee, the pump house and sump required a great deal of attention. In addition, nearly all the raises, all main level drifts and some of the crosscuts in the sub-levels required lines. The item "Michigamme river water power takes into account the surveys made from Republic to Lake Michigamme and also the preliminary investigation and figures prepared by Mr. LaCroix. The item "Carbon reports" covers all of Mr. Osborne's time in connection with the diamond drills. The Republic Iron Company's lands refer to the abstract maps prepared by the Abstract department and printed by the Engineering department. It also covers some of Mr. Derby's time spent on lands near the Republic mine.

The following table shows the number of days of the department's time spent at the various mines surveyed by the Ishpeming office for the last four years:

EXPLANATION: The 24 days noted for the Bunker Hill mine for 1912 means that either one man spent 24 days or three men spent eight days each at that property. Likewise under Jackson mine for 1913, either one man was employed there for 108 days, two men for 54 days, three men for 35 days, etc:

	1911 DAYS.	1912 DAYS.	1913 DAYS.	1914 DAYS.	
Athens mine	10	122	190	137	
Bunker Hill mine	3	24	21	30	
Chase mine	68	28	62	60	
Cliffs Shaft mine	389	347	272	301	
Dexter mine				57	
Imperial mine	134	45	3	4	
Jackson mine	60	190	108	11	
Lucy mine	79	15	42	16	
Lake mine	182	163	153	140	
Lloyd mine	175	143	104	128	
Maas mine	176	205	301	228	
Moro mine	52	17			
Morris mine	175	226	110	77	
Negaunee mine	865	752	427	214	
Salisbury mine	137	137	127	119	

The following is a table showing the number of men employed in the Engineering department in the Ishpeming office for the last

1911.		1912.		1913	1913.		1914.	
NAME.	MONTHS.	NAME.	MONTHS	. NAME.	MONTHS	NAME.	MONTHS.	
C.J.Stakel	12	C.J.Stakel	12	C.J.Stakel	12	C.J.Stakel	12	
R.D.Skelley	9	R.D.Skelley	3	J.F. Hanst	12	J.F. Hanst	12	
J.F. Hanst	12	J.F. Hanst	12	H.O.Moulton	12	H.O.Moulton	12	
C. T. Kriebel	12	C.T.Kriebel	7	R.J. Chenneou	r 12	R.J. Chenneour	12	
E.C. Weinsheim	er 12	E.C. Weinsheime	r 6	J.K.Osborne	12	J.K.Osborne	12	
R.J. Chenneour	12	R.J. Chenneour	12	W.L.Scanlan	9	J.E. Hayden	12	
H.O.Moulton	12	H.O.Moulton	12	J.E. Hayden	12	E.L.Derby	12	
J.K.Osborne	12	J.K.Osborne	12	M. F. LaCroix	12	M.F. LaCroix	9	
J.E. Hayden	4	J.E. Hayden	12	E.L.Derby	12	F.G.Rockwell	7	
M.F.LaCroix	6	M.F. LaCroix	12	John Trosvig	12	John Trosvig	92	
E.L.Derby	6	E.L.Derby	12	Albert Rock	12	Albert Rock	12	
E.G.Sterling	12	E.G.Sterling	12	Edward Ham	7	Edward Ham	8	
Fred Flink	6	Fred Flink	5	Arthur Aas	12	Arthur Aas	92	
Albert Rock	12	Albert Rock	12					
John Trosvig	7	John Trosvig	12					
Arthur Aas	12	Arthur Aas	12					
		W.L.Scanlan	8					

four years:

From above table the average number of engineers employed per month is as follows:

1911 - 13 1/6. 1912 - 14 5/12. 1913 - 12 1/3. 1914 - 11 7/12.

Since October 15th the department has consisted of nine men.

The following is a detailed description of the work done by the various men:

C. J. Stakel had general supervision over the office force. During the month of January the annual report required practically all of his attention. Maps of the Negaunee and Maas mines were prepared for the State Tax Commission. He also made maps showing the proposed division of the mineral rights under Lakes Ogden and Sally. The annual report books were assembled and taken to the Stenglein Bindery about the middle of February. During March new mounted maps of the Iron Cliffs drive territory were made. Check surveys were run in the Morris and Lloyd mines and some attention given to the proposed draining of North Lake and the swampy area over the Morris mine. He assisted in the preparation of copies of the surface and underground surveys for the Cleveland and Negaunee offices. During the month of May, the summer's field work was started and he spent ten days on Section 5, 47-27 assisting the crews in taking contours, rock exposures, etc. He spent the last week in May assisting on the survey which was carried down the Pascoe shaft, Republic mine, and making surface surveys connecting the main hoisting shafts. During the month of June, three quarters of his time was spent on the Republic surveys. Some attention was also given to the Iron Cliffs drive surveys. He and Mr. Derby also ran a line of elevations from Republic to Lake Michigamme, checking them back to Republic. The Dexter mine surveys then received attention for three days. The Section 11 contour maps were checked over during August and September and previous errors rectified. During September, the Lloyd shaft was plumbed twice, lines taken off on the 3rd and 4th levels and

the position of the ventilating raise checked on surface. The 1914 annual report was also started by taking the views during the latter part of September. The Republic Iron Company's land on Section 4, 47-28 was surveyed. He and Mr. Osborne ran a check survey from surface to the breast of the 14th level, Salisbury mine. During the latter part of October, he spent a few days with the men contouring Section 12, 47-27 and Section 18, 47-26. The balance of the year was devoted to supervising the 1914 annual report, in addition to making the Dexter and Mass mines annual report maps.

J. F. Hanst, who has charge of the concreting at the Athens shaft, spent about one half of his time at that property. The rest of the year he was stationed in the Ishpeming office. He colored in the 1913 annual report prints of the Cliffs Shaft, Salisbury and Crosby mines. He prepared the 1913 blue prints of the Cliffs Shaft mine for the State Tax Commission. The Cliffs Shaft ore estimate maps were finished. At intervals of about three months, the Cliffs Shaft geology was mapped and posted on the geological tracings and sections. He assisted Mr. Stakel in preparing the copies of the surface and underground surveys for the duplicate records. The Gwinn abstract maps were completed by Mr. Hanst. During the month of May, he started work on the coordinate survey lines on Sections 13 and 24, 47-27. He also prepared a number of maps of the Republic mine, which accompanied the report regarding the purchase of that property. A map of the Marquette Range was completed for the Lake Superior Mining Institute. He also printed all of the annual report view negatives, later putting borders on the prints and looking after the descriptive titles on them. The Cliffs Shaft stockpile was estimated at the close of the shipping season. A tracing of the proposed division of the mineral rights under Lake Sally was prepared. He also made a tracing showing the ownerships along the proposed Republic-Dexter pole line.

H. O. Moulton had charge of the Cliffs Shaft mine surveys during the entire year. He assisted Messrs. Hanst and Eaton with the ore estimate during the month of January. During Rebruary and March, he ran check surveys and elevations over points on the main levels, carrying the completed surveys into the breasts of the drifts extended during the last two years. The pump house and sump on the 15th level "A" shaft required a great deal of attention during the summer months. At the close of every month, he made the monthly surveys and blue prints. He also devoted considerable time to the Section 3 maps and tracings and the coordinate line surveys in the Iron Cliffs drive territory. An entire new set of 50' to the inch tracings of Section 3, 47-27 was made and photographed. In the Iron Cliffs drive territory he surveyed Lakes Minnie and Miller. He also contoured the favorable iron formation on Sections 12 and 13, 47-27. Coordinate survey lines were run out on Sections 22, 23, 24, 25, 26 and 27, 47-27 and Section 19, 47-26. He prepared the abstract maps of the Bunker Hill property and on May 1st he estimated the coal in stock at the Ishpeming mines.

R. J. Chenneour made the surveys in the Mass mine and when that property was closed he was transferred to the Negaunee mine. In addition to the routine work required at these mines, which consist of monthly surveys, giving lines for raises, crosscuts in sub-levels and the development work on the main levels, the pump house and sump at both mines required a great deal of attention. He also assisted the Geological department in mapping the geology of the working places. At the Mass mine, check surveys were run on the lst, 2nd and 3rd levels and the 2nd level Mass and 10th level Megaunee surveys tied in at the boundary line between these two properties. He assisted Mr. Elliott in making the Mass-Megaunee ore estimates. Abstract maps of the old Iron Cliffs Company's lands were started. He assisted on the Sections 5 and 13, 47-27 contour surveys and also mapped the West half of Section

18, 47-26. The new buildings, fence lines, railway tracks, etc. on the Athens, Lucky Star and Breitung-Hematite surface were surveyed. Drawings were made for Mr. McClure showing the heights of all telephone and electric light wires over the L. S. & I. Railway in the cities of Ishpeming and Negaunee.

J. K. Osborne devoted the majority of his time to the Salisbury and lake mines and the carbon and diamond drill reports. During the months of March, April and May, he made the Take mine surveys. On Election Day, a special check survey was carried around the East and West loops on the 4tn level Lake mine. On the 5th level a check survey was carried from the shaft to the breasts of both East and West drifts. Lines were given for the contracts drifting on the ventilation sub. Elevations were established at all raises on the main sub-level drifts. At the Salisbury mine, a special survey was carried down No.5 shaft from surface to the 14th level plat and thence to the 14th level breast. About twice a month lines were given this contract, which is headed Southeast towards D.D.H.No.4. At the close of each month he got out the regular monthly survey. He also devoted considerable time to the Section 11 contour maps. New mounted maps and tracings were made of the Northwest quarter and the North half of the Northeast quarter. Mr. Osborne also looked after the carbon. Monthly reports were turned in and occasionally special reports regarding the condition of the carbon were made. The diamond drill inventory was gone over twice, once in January and again in November.

J. E. Hayden spent nearly all of his time in connection with work in the North Lake district. The Lloyd mine required most attention. The shaft was plumbed twice and development work on the 3rd and 4th levels looked after. At the Morris and Chase mines, the routine work required attention and in addition check surveys were run on the 2nd and 3rd levels Chase mine and the 1st level Morris mine.

As the Dexter mine was unwatered, surveys were carried from surface

down to the various levels. The underground diamond drill work was looked after. Section 5, 47-27 was contoured during the month of May, Mr. Hayden assisting on this work. He also spent a week on Section 1, 47-28 contouring the area South and Southeast of North Lake. Frequent trips were made to Sections 2 and 3 in order to give locations for the diamond drills. The Republic Iron Company's lands on Section 4, 47-28 were surveyed and he also assisted Mr. Moulton with the contour surveys on Sections 12 and 13, 47-27. He made the contour maps and tracings of Section 9, 47-27. He also finished a series of abstract maps of the Pendill lands in Sections 6 and 7, 47-26. He was absent from the office about a month on account of illness.

E. L. Derby was in charge of the Negaunee mine surveys until June 1st, after which date he was transferred to Republic, Michigan. At Negaunee he took care of the routine mine work and also looked after the concrete work in the 10th level sump. The drifts and raises on the 10th level also received attention. The contours on the Bunker Hill mine surface were plotted and a new mounted map made of the North half of the Southwest quarter of Section 6, 47-26.

At the Republic mine, a check survey was first carried down the Pascoe shaft from surface to the 2050' level. Surveys and elevations were then run on two of the cross-over levels between the Pascoe and No.9 shafts. Plumbing wires were hung in No.9 shaft and the old Republic Iron Company's surveys checked on the two bottom levels in this shaft. No.9 shaft was also retaped from surface to the bottom level and bench marks for elevation established on every important level. A set of mounted maps and tracings of all working and important levels were then finished. A complete survey of Section 7, 46-29 was made and maps and tracings finished showing all topography except contours and outcrops. A portion of Section 18, 46-29 was surveyed and mapped. Elevations were also carried up the Michigamme river and back from the town of Republic to Lake Michigamme. Mr. Derby also assisted Mr. Bruce Wallace on all monthly and special surveys until the close of the year. He also finished a set of annual report trac-

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ings of the underground levels, of the 50' to the inch maps of Section 7 and of the 200' map of Section 18.

M. F. LaCroix, who does the engineering in connection with the Lake mine, made the usual surveys, with the exception of the three months he was away on his leave of absence. At this property he also made a number of efficiency tests with various types of drills and drill steels. He also assisted on the air tests made for the Safety department. The yearly ore estimate was finished and blue prints prepared for the State Tax Commission.

He finished some of the Section 4, 47-27 contour maps and did some work on the Athens and Section 35, 48-25 abstract maps. He left the office on his leave of absence on March 16th and returned on June 8th. The majority of his time during the months from June to November inclusive was spent in the Iron Cliffs drive territory where he assisted on the coordinate line surveys and running levels. He also devoted some time to preparing figures in connection with the Michigamme river water power for Mr. Jopling. He mapped the contours and topography on a portion of the Neely lease in the Crystal Falls district.

Engineering department on May 7th. Since November 1st, he has divided his time between the two departments. He assisted Mr. Hayden on the North Lake district surveys and maps and while Mr. Hayden was absent because of illness he had charge of the work in the North Lake district. He ran two check surveys on the 4th level Lloyd mine from the shaft to the ventilating raise. He also carried a careful survey from the collar of the Lloyd shaft to the collar of the ventilation shaft East of the Lloyd mine. The Lloyd shaft was plumbed twice from the 3rd to the 4th levels, mr. Rockwell taking the lines off on the 3rd level each time. He assisted Mr. Derby for two weeks at Republic and spend a little time with Mr. Moulton on the Iron Cliffs drive surveys.

John Trosvig was employed until October 15th. During January and February he assisted Mr. LaCroix with the Section 4 50' to the inch contour maps. During March he made a series of 200' to the inch mounted maps of the old Iron Cliffs Company lands on the iron formation in T. 47 N. R. 26 W., T. 47 N. R. 27 W., and T. 47 N. R. 28 W. Point map tracings of all these sections were also finished. He laid out all the new mounted maps for Section 5. 47-27. During May and June he assisted on the Section 5 and Section 13 contour surveys and also ran elevations over all the survey stations established on the East-West coordinate lines in Section 5. Previous to June 1st, he also assisted Messrs. Derby and Chenneour on all the Maas and Negaunee mines surveys and from June 1st to October 15th he had charge of the Negaunee mine himself. During this time he made regular monthly surveys, ran check surveys on the 10th level and gave lines for the main drifts and raises. He also assisted Mr. Freeman in mapping the geology of the underground extensions.

Albert Rock was employed as a helper during the entire year. During the months of January, one half of February and all of December, he was kept busy making annual report prints. During March, April and May he was employed as a helper on the underground surveys and during the rest of the year he assisted on various surface surveys, besides doing odd jobs about the office.

Arthur Aas and Edward Ham were employed as helpers, the former until October 15th and the latter until September 1st. Both of them were employed in the main office until the Republic surveys were started and then assisted Mr. Derby until the field work was finished.

Four axemen were employed during May on the Section 5 contour surveys and from two to three axemen were employed in the Iron Cliffs drive territory until November 16th.